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Scientific Review
AND
SCIENTIFIC AND LITERARY REVIEW,
A RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,
INCORPORATING THE
Journal of the Inventors' Institute.

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APPLICATIONS FOR LETTERS PATENT.

*** In this list (Com.) means Invention communicated from abroad.

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SCIENTIFIC REVIEW
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Scientific and Literary Review.
A RECORD OF PROGRESS IN
ARTS, INDUSTRY, AND MANUFACTURES,
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JUNE 1, 1876.

THE PATENT LAW IN PARLIAMENT.

In a country like our own, that can only hope to maintain its position by progress, whether in science or the industrial arts, nothing can be more interesting than the question of legislation intended to be promotive of such progress. Hence hereby most prominently is recorded the proceedings taken by the Inventors' Institute on the subject of the Lord Chancellor's new Patent Bill, which, if passed as it now stands, will be in nowise promotive of, but in fact a great hindrance to, scientific and industrial progress.

Following up the action taken at the preliminary conference, held at Sir Antonio Brady's offices, Cannon Street, in March, and the subsequent public conference at the Society of Arts in April last, the proceedings whereof were reported in the Scientific Review for May, the Committee appointed at the last-named meeting assembled on 9th May, and after much discussion the subjoined petition to Parliament was unanimously adopted, which will be found to incorporate the resolutions passed at the public conference, such petition having been prepared by Admiral Selwyn.

Petition.

"*To the Honourable the Commons of the United Kingdom of Great Britain and Ireland in Parliament assembled.*

"The humble petition of the President, Council, Members of the Inventors' Institute, and others interested in Inventions and Letters Patent, and in the prosperity of the manufactures and industrial operations of the United Kingdom,

"Humbly Sheweth,

"That your petitioners are engaged in various ways in the industrial arts, and that in their judgment the progress of invention is the most powerful means of simplifying and improving all those arts, processes, machinery, and manufactures, on which this country has for many centuries mainly relied for pre-eminence in commerce, and on the maintenance of which, under Providence, the wealth, power, and well being of this country depend.

"That we view with the greatest distrust the Bill on the Patent Laws now before the House of Commons, as tending to hamper and impede the progress of Invention.

"We respectfully submit to your Honourable House—

"That no change in the existing Law will be satisfactory unless it provides for the following results:—

"1st. A more simple mode of obtaining Patents.

"2nd. A more exact registration of Inventions.

"3rd. A better title to the Patent when obtained.

"4th. An extension of duration of Patents to twenty-one years or some period more in conformity with the privileges granted under the Copyright Act.

"5th. A reduction of fees, so that in all stages they shall not amount to more than £10.

"The two latter clauses are urged in order to assimilate the provisions of an amended Bill to the United States Patent Law, in the hope of eventually obtaining an International Patent Law; and in accordance with certain propositions which have been unanimously agreed to, at various Conferences held in order to ascertain as far as possible the opinion of all classes interested in whatever branch of the subject. These are as follows:—

"That the truest and highest public policy requires that Inventors and their Inventions should receive the protection and encouragement of the State.

"That this protection should be placed on the same basis as the protection given by law to all other property, acquired or created.

"That the encouragement should be, first, by correct Registration of all Inventions in the Patent Office; secondly, by free access for Inventors to the Examining Staff and their Records; thirdly, by a lowering of the Cost of Protection, so as to bring such Protection within the reach of every Working Man.

"That the only method by which an inventor ought to be rewarded, is by the pecuniary results of his invention for a limited period, and not by State rewards.

"Your Petitioners therefore pray that provision may be made in any Bill on the Patent Law for the propositions above-stated, before it receives the sanction of your Honourable House.

"And your Petitioners will ever pray, &c.,

"Signed by request, on behalf of the Petitioners,

"Antonio Brady, President, Inventors' Institute.
"F. W. Campin, Secretary, Inventors' Institute."

It was agreed at the Committee above-mentioned that Mr. Sampson S. Lloyd, M.P., should be asked to present it to the House of Commons, and to move that it be read at the Table of the House. Mr. S. S. Lloyd kindly consented to do this, and it has been presented and read accordingly.

The Artizans' and Inventors' Committee, a body composed principally of artizan inventors, which was formed last year, and has been reconstituted this year, have held several meetings, and prepared a petition to be presented to the House of Commons, as also a memorial which is to be presented to the Law Officers of the Crown, which memorial,—an echo of the petition,—runs as follows:—

Memorial.

"Your memorialists, associated together under the title of 'The Artizans' and Inventors' Patent Law Amendment Committee,' are engaged in various branches of industry as artizans; and as inventors, having inventions affecting the same, have learnt that a Bill is now before the Honourable House of Commons, in charge of Her Majesty's Attorney-General, entitled 'The Patents for Inventions Bill, 1876,' and, much to their regret, they find this Bill to contain provisions likely to prove injurious to inventors and the progress of invention, which, as your memorialists most respectfully submit, is of vital importance to the welfare of this country; and further, that such Bill does not provide for any reduction in the cost of Patents, without which no amendment of the law will be of any value to the majority of inventors who are men of small pecuniary means, as are the majority of your memorialists. And such cost requires reduction especially as regards the first stage, usually termed 'Provisional Protection.'

The points with regard to the said Bill which your memorialists would submit to your consideration are these:—

"1. That the arrangements for examination are inadequate, and that the examination comprises an enquiry into the frivolity of an invention, a matter that cannot be settled by anyone.

"2. Unnecessary complication of formalities in obtaining Patents, and continual references to the Lord Chancellor, which must inevitably lead to great delay and expense.

"3. Vexatious provisions as to compulsory Licences and use of invention by the patentee within far too limited a period after the date of his Patent.

"4. Want of a cheap (that is, of not greater cost than *one pound*) Provisional or Preliminary Protection.

"5. Necessity for a large reduction in the cost on all stages of the Patent.

"Your memorialists earnestly solicit that you will, in accordance with the above, aid them in getting the Bill amended so as to be freed from the objections above set forth."

Reviews.

BLASIUS ON STORMS.

"Storms: Their Nature, Classification, and Laws, with the Means of Predicting them by their Embodiments the Clouds." By WILLIAM BLASIUS, formerly Professor of the Natural Sciences in the Lyceum of Hanover. Philadelphia: Porter and Coates, 822, Chestnut-street. London: Lockwood and Co.

THIS is a work of earnest scientific research, which cannot fail to be highly appreciated by all who take an interest in the important subject of which it treats.

In the preface of the work, which is dedicated to Professor J. H. Blasius and Professor Louis Agassiz, the author says:—

I fulfil a long-cherished desire, and one which has received additional strength as often as accounts have reached me of the terrible disasters at sea taking place almost daily, and which can be to a great extent avoided by knowing the true nature of storms. I am convinced that the existing theories of the nature and laws of changes of weather are intrinsically erroneous, and that at least a much nearer approximation to the truth will be found in this volume.

I have not until now published the conclusions to which I had arrived principally because I found it necessary to corroborate them by other witness than my own. Twenty years ago I in vain exhausted every effort to obtain a hearing for what I believe to be the truth, and I have patiently awaited the development of the science and the formation of those investigating corps by whose observations I most hope my views would be confirmed. When, a few years since, these institutions, for which I had laboured so many years ago, became at last a realized fact, another difficulty presented itself in the method of investigation pursued; observations are made only at fixed periods of the day, which I am thoroughly convinced will never lead to definite results, since it necessitates averages, while I have aimed at a knowledge of individual phenomena by continuous observation. The consequence of the method of observation generally pursued is that an area of barometric depression is considered the storm itself, and the *cause* of the movement of air-currents, while I am certain that the storm is the conflict of air-currents of different temperatures, and the barometric depression the *effect* of their movement. And, in addition, the most important elements in the life of storms—heat, their originator, and the clouds, their embodiments—are those to which least attention has been paid.

In endeavouring to reach results from tangible facts, I have been compelled to discard much of the theoretical terminology at present in use—such as the terms "cyclone," "anti-cyclone," "dangerous semi-circle," "manageable semi-circle," "centre," "gradient," &c.—and to substitute such as grew out of the development of the subject. Some familiar terms—as for example "stratus," "cumulo-stratus," "equatorial and polar currents," &c.—I have preserved, although in some cases with a slightly altered significance; their use, however, will be readily understood. Instead of the modern invention of the "barometric gradient," from which so much has been hoped and so little realized, I have introduced the *plane of meeting* (for which in the German language I would propose the name *Begegnungs-flache*). It is defined in its position to the storm by the clouds, and has a meaning and an intimacy with the life of storms which make it more comprehensible and useful than the gradient; and it is besides much older, having been explained in my lectures twenty-two years ago. I have found it necessary to represent the circulation of the atmosphere somewhat differently from the common acceptation, in order to explain the regions of calm (the "horse-latitudes"), the increased atmospheric pressure at the tropics, and the frequent existence of lower temperature there than in higher latitudes (see Blodget's "Climatology of the United States") as well as some other phenomena. It would appear that Lieut. Maury has been credited as the author of the explanation of the calms at the tropics, but in a letter to me of Nov. 29th, 1852, in acknowledging the receipt of my article in the New York *Times* (Appendix A), he says: "You have classed me in the storm-field, I observe, but I have not entered it either as a theorist or as an advocate of any theory. I am holding back for my facts yet." However, even if Lieut. Maury had conceived and published his explanation of the tropical calms before he received the New York *Times* article, his theory in truth neither explains the calms nor is in accord with the dynamics of aërial currents.

In conclusion, I trust that scientists will excuse in the following pages the positiveness of statement which is born of conviction, and the introduction of many explanations with which they are already familiar, but which may be unknown to the general reader. The introductory, although of necessity personal in its tone, is important to a thorough understanding of the subject, and I should therefore wish it read. The chapter on "Corroborative Evidence" will be found to contain in great measure the practical application of my principles.

The author adds:—I cannot close these remarks without expressing to Joseph H. Coates, Esq., my heartiest thanks for the valuable assistance he has given me in preparing this work.

The several chapters of the book treat on the Situation of the Science of Meteorology; Aërial phenomena, their causal connection with the various Cloud Formations, and the Classification of Storms, Local Storms and the primary origin of atmospheric disturbance; Progressive Storms; Weather Prognostics from the clouds, with special hints for navigators and meteorological observation.

BARRY ON RAILWAY APPLIANCES.

"Railway Appliances: A Description of Details of Railway Construction Subsequent to the Completion of the Earthworks and Structures, including a Short Notice of Railway Rolling Stock." By JOHN WOLFE BARRY, Member of the Institution of Civil Engineers. London: Longmans, Green, and Co.

THIS work forms another of the series of Text-books of Science issued by Messrs. Longman, and it fully bears out the promise of the previous works, and can compare favourably with any of its predecessors.

The purpose of the work is, the author informs us, to describe the different material adjuncts, the appliance of which marks the distinction between the mere road-bed, more or less straight or level, on which the rails are laid, and that elaborate system for the safe and speedy conveyance of passengers and goods which is practically known and talked of under the vague designation of a railway. The book is thus not intended to deal with the construction of the earthworks, bridges, and viaducts on the one hand, nor with the financial management of the company on the other, but with the intermediate—though equally important—matters which complete the railway, and which are necessary for working the traffic.

The first chapter deals with Acts of Parliament and other regulations affecting railways. Permanent way is treated in the second chapter, and in the third chapter points and crossings, in which we find some very practical observations as to the dangers of facing points. Chapter four deals with signals, and in chapter five the block system is described. Everyone is fully alive to the necessities of this system, although in some instances it may have failed through neglect or otherwise. Chapters six and seven deal with stations and rolling stock respectively.

We have thus given the subjects of the chapters into which this work is divided, and our readers will see the interesting character of the work; for, although it may be presumed the work is more for those engaged in engineering pursuits, yet the general reader will find much that will interest him, and to both these classes of readers we cordially recommend the work.

TWINING'S SCIENCE MADE EASY.—A Series of Familiar Lectures on the Elements of Scientific Knowledge most required in daily life (Chapman and Hall, publishers).—This is a very valuable and useful aid to technical instruction; but, as we wish to do full justice to it, circumstances have compelled us to postpone our review. Several other reviews are also postponed.

FASCINE WORKS AT THE OUTFALLS OF THE FEN RIVERS, AND RECLAMATION OF THE FORESHORE."

BY MR. W. H. WHEELER, M. INST. C.E.

FOUR rivers which take the drainage of the Fens of Lincolnshire and Cambridgeshire, and the lands bordering thereon, discharge into an estuary filled with large beds of shifting sands, and in order to secure an outfall for these rivers it had been necessary to train their channels through the sands. The most economical way of accomplishing this had been by means of training walls, constructed of fascines and clay and chalk. Very beneficial results had followed from this training and straightening of the outfalls, and the low-water mark had been lowered several feet. The advantage of confining the rivers to one course was shown by the fact that when in the trained portions of the channels there was a depth of 10 feet at low water, below it there would be a depth of only from 2 to 3 feet. The faggots used for building the training walls or jetties were made from thorns cut from the edges, tied together with tarred string. The length of each faggot was 6 feet, and its girth 3 feet. These were thrown into the water from barges and weighted with clay, layer after layer being thus placed, until the jetty was brought up to half-tide level. The depth of water in which these jetties had been built varied from 10 to 20 feet, the top being 6 feet above low water. The base of a jetty 16 feet high was 22 feet wide, and the top 13 feet. The cost per lineal foot for the work done on the Witham averaged 19s. 3d., or 1s. 8d. per cubic yard, the details of which were given. The thorns and clay together formed such a compact mass, that the jetty was able to withstand the force of both the ebb and tidal currents, and was a cheap and effective means of carrying out the training of these rivers.

After the formation of the jetties, the sand and silt accumulated at the back, and ultimately grew into green marsh. The accretion of land was gradually taking place all along the foreshore of the Wash, but to a much greater extent on the Lincolnshire than on the Norfolk coast. The process of accretion was very slow, unless assisted by artificial means. The marsh when formed never extended over half a mile from the old enclosure; having attained this distance the growth ceased, the ebb current of the retreating tide being then sufficiently strong to carry back with it the alluvial matter contained in suspension. The first formation was silt and sand. Warp or alluvial soil first began to deposit at 12 feet below water. When the surface rose as high as neap tides samphire appeared; this was succeeded by grass, and the growth of the marsh continued until a height was reached equal to about an ordinary spring tide. A marsh, under favourable circumstances, would reach a stage fit for enclosure in about thirty-five or forty years. The process of accretion might be hastened by placing faggots across the foreshore to break the force of the water and so assist in the deposit of warp, and by inoculating the ground with sods cut from the adjoining marshes. The Crown claimed a right over all these foreshores. The principle area of the land having risen above ordinary high water, the Crown had no longer a claim on it, but compensation had to be paid before enclosure for the rights over the creeks and low places by which the marshes were intersected. These claims had been settled on the merits of each particular case, several instances being given of the terms. The value of the salt marshes for feeding sheep before enclosure was from 5s. to 6s. an acre, and the value of the freehold £20. The cost of enclosure was from £15 to £20 an acre, and the value of the land after enclosure from £50 to £60.—*Abstract of Paper read at the Institution of Civil Engineers, May* 2.

HENLEY'S IMPROVED RUDDER.

As a member of the Inventors' Institute, I beg leave to bring under the notice of its members my invention for the improvement of shipping and unshipping rudders, available for ships, yachts, barges, and boats of every class, an invention that must doubtless prove of great utility to the world at large. The difficulties of repairing the rudder of a vessel at sea is well-known, and many fine ships have doubtless owed their destruction to the fact of the rudders being carried away in a heavy sea. Last year the Sydney Dacres, a well-found ship, was abandoned off the coast of Ireland, solely through the inability of those on board to fit a jury rudder in the place of the one carried away from her. Numerous inventions have been patented, which profess to render an accident of this nature an impossibility. Practical trials have, however, demonstrated that up to this time injury to the steering gear can never be effectually prevented. Under such circumstances the question arises, why should not ships carry a spare rudder at sea with them, and have it ready in case of accident? The answer to this has hitherto been the almost utter impossibility of fixing a spare rudder when the vessel is at sea. I feel convinced that I am able practically to demonstrate to the world that my invention can, and will, overcome every difficulty in this respect, as will be seen by my models. For the purpose of shipping and unshipping the rudder at sea an aperture just large enough to allow the rudder to slip through easily is cut in the counter, and instead of pintles and gudgeons a slot-tube the length of the stern post is fixed to it, with its after side slotted so as to admit of the rudder post working easily up and down. The rudder is the shape of the ordinary rudder, with the exception that in lieu of the usual rudder post, an iron post is substituted, which fits the hollow slot-tube fastened to the stern-post; the heel of the iron rudder post fits into a socket at the lower part of the slot-tube, while the upper part works in a bearing on deck; the rudder is lowered down from the deck through the aperture, the tiller is then fixed, and the aperture closed, and the vessel is again under command. I also apply a screw fixed in the bearings on deck, which prevents the rudder from unshipping, and acts as a break to prevent the rudder kicking in a heavy sea way, as well as to take command of the same when the tiller ropes or chains are carried away, or the rudder head is rung off, as in the case of the Great Eastern. By this invention, should the rudder receive damage at sea so as to render it useless, it can immediately be got on deck, and the spare one sent down, or be quickly repaired and shipped again. The same principle I apply to boats and craft of every kind. Again, should the ship strike on a sand bank or on a rock, by keeping the rudder in midships, and giving a turn back of the set screw, the rudder would be raised by the blow, and by means of the set screw might be kept up any distance out of harm's way.

I cannot help thinking that this subject has not sufficiently commanded the attention of our mercantile community, considering the serious losses that have occurred; some of which have alone been caused through injury, in some way, to the steering of the vessel; to say nothing of the number of missing ships that are lost every year and never heard of again. Under the present system of fitting rudders, no remedy whatever is provided for the repair of rudders at sea. The application of the same to small boats will be found very expeditious and safe, saving the trouble, as under the present system, of putting the arm under water in order to find the hole of the lower gudgeon, whereas, under this invention, the boat's rudder is simply entered on top of the slot-tube, and drops down into its place even with the most unskilful handling.

It is, therefore, obvious, that the sooner our mercantile marine becomes acquainted with, and adopts the new system of rudder shipment, much saving of life and property will be effected. Having had much experience at sea, I speak from experience. In conclusion, I must apologise for taking up so much of the time of the members of this institution.

The above is the substance of Mr. Henley's paper recently read at the Inventors' Institute. Its reading was illustrated by models, and followed by discussion, which appeared to elicit a general approval of the invention.

FOREIGN SCIENCE.

HAVING in view the scope of this journal, which, as its name indicates, is particularly a scientific one, the increase of skilled as well as general knowledge, the exploration of the vast *prés dorés* or golden meadows of the skies and of hidden nature, which are more enduringly beautiful than the smiling fields of the Island of Calypso, we are glad to greet the efforts which French savants are making to develop every kind of learned knowledge, including practical science. A fine meteorological observatory has recently been erected on the lofty summit of Puy de Dom, which overlooks the surrounding mountains. It is believed that in consequence of this work of Professor Alluard, of Clermont-Ferrand, new light will be thrown upon the natural history of the world. This is not a novel idea, and we can scarcely propose it to English savants as matter to inaugurate; but we may recommend that the course shall be as *carefully* followed out and up as is the case with our neighbours.

We see that a learned contemporary at Paris pays us the compliment to say that in England, men whose avocations would seem to remove them from works of the mind, sometimes cultivate science with distinction. Works of great merit are cited as emanating from a financier, a merchant, an artizan. That in France they are not accustomed to similar good fortune; still it affords them lively satisfaction to find an example. However, a merchant of Cognac—a town which has "other associations"—has discovered a new metal associated to zinc in a very minimum proportion, which he has christened *gallium*. It seems this has been accomplished under great difficulties. He found the separation from the state of combination with other metals very trying. So far back as 1875 (August 27), submiting a mixture from the mine of Pierrefitte, in the valley of Argelès, to chemical test he discovered the probable existence of a new simple body. He has published some important memoranda relative to supersaturation, the formation of facets of crystals and the molecular equilibrium of solutions of alum of chrome. Scarcely any traces of the rays of zinc are now found in the metal; and the discovery is adjudged a success by the Academié des Sciences. The following statement is interesting:—"The always advancing development of industry and steam navigation has more than once inspired grave reflections for the future. People ask what is to happen when the coal mines are exhausted. Of the forests of old Gaul, there will be only an historical recollection. All the wood which is gathered in a country almost entirely given up to cultivation, will count for little to aliment manufactories and to drive steamers. The bearings of coal discovered on different parts of the globe reassure us, indeed, for a long time; nevertheless, the time will come when combustibles will fail. Professor Mouchot, of Tours, has discovered the means of satisfying the habitual wants of a household at certain hours, and yet employing no combustible. For example, he demands a fine sun, and such a requisition makes one shudder, for, in the absence of fire in the furnace, it would be necessary to do without dinner on cold, rainy, and foggy days." We should be still worse off in England, we may state, *en passant*. However, to resume. "The experiment of M. Mouchot is worthy of most serious attention. The apparatus invented by the engineer-physician (a new professional combination) is composed of a metallic mirror with a linear hearth, with a blackened copper formed of two envelopes having between them a space destined to receive water; in fine, a glass bell which brings the solar rays to the copper, and hinders them from escaping when the black surface has transformed them. By means of gear facing it, the apparatus turns at 15 degrees an hour round a tree parallel to the axis of the earth, and is inclined gradually upon that tree to answer to the declinature of the sun."

Before going into more specific details, we may mention in regard to the astronomical progress accomplished in 1875, and the reduction of observations made in 1874 (8th December), that the longitude of the stations of Mauritius and Rodrigues measured from Suez with fifty chronometers, by Lord Lindsay, have been reduced by his cases in the most satisfactory manner. This did not, in a great measure, form part of the Government work. In Germany exertions continue to be made, especially by the military, to improve balloons. It is especially sought to discover means of mounting or descending without throwing out ballast or gas. Balloons should not be too large, and the covering must be as dense and at the same time as light as possible. Just now skilled persons there are studying what ought to be the most suitable proportion, also what would be the best shape to give the wings, and their number. Any person who could discover, by means of properly directing balloons, would, of course, confer a great favour. Dr. Lecadre, of Havre, announces the melancholy fact that increased industry, in bringing the country inhabitants to large centres, and refinement of manners, has multiplied consumption. M. St. Claire Deville, communicating to the Academy of Sciences upon the comparative behaviour of the thermometer and barometer during the tempest of March of this year (1876), says, that the detailed analysis of this remarkable movement of the atmosphere shows, then, in the first place that the periodical oscillation of the temperature from the 9th to the 13th of March, has not failed to be produced; in the second place, that the law of non-synchronical parallelism of the temperature and pression is even realised in the roughest variation of these two meteorological elements. A General Morin suggests chronometrical apparatus to give continuous indications of the state of the thermometer and barometer. A M. Bourbouze is learned on the subject of communication to a distance by the courses of water. He says when the two extremities of the thread of a sensible galvanometer in contact—the one with the pipe which brings the gas into the laboratories, the other with the water conduits, the existence of energetic currents in the circuit so formed is easily demonstrated. Analogous results are reached in placing one of the extremities of the thread or cord in communication with a water course, the other with a piece of metal sunk in the earth, or, still better, one with a well and the other with the earth. To sum up the totals of my experiences demonstrates that we can communicate telegraphically without thread or cord to distances more or less considerable; we can substitute telluric currents for those of the piles generally employed, provided that the immerged surfaces are made to vary; in fine, these currents can decompose the dissolutions of metallic salts.

M. Ferrari has been paying erudite attention to the radiating point of the shooting stars of the month of August. From 1872, as we observe from the lithographic tables published then in our meteorological bulletin, where use has been made of the stereographic table of Professor Dornat, director of the Astronomical Observatory, Turin, it was evident for all the series of observations that the principal radiating point of said stars for August is found for our station in the constellation of Cassiope rather than Perseus. If we were to indicate the radiant with a line for 9th August, 1872, it would be the line which joins *a* of Perseus with Θ of Cassiope.

The fact of the diffuse radiation for the period of August is confirmed; and the case of the symmetrical radiation for the square of Cassiope which determines the radiant more precisely.

We are much indebted to *Les Mondes* for above particulars.

We find that the following are the new French and Belgian works just published—namely, a truly valuable work, "Elements of Pathology," by Baron Nelaton, in which eye and ear are much considered; and "Monography of Birds of Belgium," by Baron Halles, Messrs. Bailliere, Cox, and Tindall, of King William-street, being the London agents.

LOAN COLLECTION OF SCIENTIFIC APPARATUS.

Passing over the Educational collections, in which Germany and Russia stand foremost, the objects which strike us on the right and left respectively are Stevenson's "Rocket" and "Puffing Billy," lent by the Commissioners of Patents. The next objects on the left and right are now exhibited for the first time in England. We refer to a steam cylinder by Papin, bearing date 1699, sent over from the Royal Museum of Cassel, and a collection of Watt's original models of various parts of steam engines contributed by Mr. Gilbert Hamilton. The steam cylinder, which was made at Cassel, is almost the only surviving witness of the works of Papin, from which a series of inventions has sprung, which have completely changed in a few decades our modes of life.

The model of the pumping machine was completed, and some parts of the machinery cast at Veckerhagen, when, in Papin's laboratory, a machine exploded by means of which he was making experiments on throwing bomb-shells by steam; Papin was obliged to take flight, and died poor and forgotten. Newcomen's engine and Captain Savary's engine also find place, as does Bramah's first hydraulic press. Mr. Bennett Woodroft contributes a large number of models.

In the series of rooms devoted to naval architecture and marine engineering, the first object, on the left, is a model of the Faraday, and, after a long line of other models, we come to Mr. Froude's (2,147), illustrating his method of ascertaining the resistance of ships by measuring the resistance of their moulds. This method is now used for her Majesty's ships. Experiments have shown that the results obtained with the models accord very closely with the ship itself; so that our Admiralty is no longer compelled to make experiments on the scale of 12 inches to a foot—that is, with the ships themselves; it has never before been exhibited, except to those who have been privileged to see Mr. Froude's laboratory at Torquay. We may state, says the *Times*, in an admirable summary from which we quote, that the models, from 6ft. to 16ft. in length, are made of hard paraffine; the experimental apparatus employed in working the model includes appliances for designing, moulding, and casting the models, shaping them by automatic machinery, moving them through the water at the required speeds, and automatically recording the leading phenomena of the trial—namely, the speed, the resistance, and the change of level induced by the speed at each end of the model. When the model exactly represents the lines of the ship the form of which has to be studied, it is put into a tank and connected with a dynamometric truck, which runs on a railway about 200ft. in length, suspended over a waterway 36ft. wide and 10ft. deep. The model floating in the water is, as it were, "harnessed" to the truck and travels with it. The towing strain—*i.e.*, the force necessary to make the model accompany the truck in its longitudinal progress—is taken during the experiment by a spiral spring, the extension of which, measuring the towing force, is indicated on a large scale by a pen on a recording cylinder. The recording cylinder is driven by the truck wheels, and thus its circumferential travel indicates distance run; at the same time another pen, jerked at half-second intervals by a clock, records time. Other pens actuated by strings led over pulleys record the change of level of the ends of the model. Thus the diagrams made furnish an exact measure of the speed and a continuous record of the resistances and of the change of level of the model throughout the experimental run at steady speed. The truck is connected by a wire rope, with a winding drum, driven by a small stationary double-cylinder steam-engine.

After models, we pass to lighthouses. Among these, first mention must be made of the magnificent series representing the earliest attempts of Fresnel, sent by the Lighthouse Service of France.

We have now soundhouses as well as lighthouses, and various arrangements for warning mariners by sound signals, from the portion of the first-class fog-signal (2,184), exhibited by the Trinity-house, to the Holmes "Aurora" fog-horn, for use on board-ship, are represented; an interesting series of drawings of the arrangements used in the Adriatic coming from Austria.

After passing through the applied mechanics section, before the western galleries are reached, there is a breach of continuity in the shape of Mr. Frank Buckland's fish collection, which is interesting, though it form no part of the Exhibition.

The first room in the western galleries is devoted to Sections 9 and 10, embracing magnetism and electricity. These include a most remarkable and interesting collection of original apparatus connected with terrestrial magnetism and the development of magnetic and voltaic electricity, and the application of the electric current in the progressive development of the telegraph. This, perhaps, is the most bewildering room of all, for it is most crowded, and steam-engines in an annexe are used for driving some machines, not necessarily electrical, for which steam power is necessary. The steam-engine has been placed gratuitously at the service of the Department by Messrs. Ransomes, Sims, and May, and the non-electrical objects driven are M. Pictet's new ice machine, and two machines the counter-parts of each other in the process of type-setting by mechanism instead of by hand as heretofore, exhibited by Mr. Walter, M.P. The printer has hitherto composed, or built up, the words and sentences of his manuscript letter by letter, each letter being taken by his fingers from its own compartment in the open case before him; and when the matter thus set up has served its purpose on the press, he has again distributed it letter by letter back into the compartments of his case. The two machines now exhibited by Mr. Walter are samples of what, after four years' practical experience, has been found best adapted to the object of getting printing, or type-setting, done entirely by mechanism. The Composing Machine, with its type arranged in tubes, explains itself. The Type-caster is the form which the new system takes, as the simplest, cheapest, and best way of getting type, on its return from the press, back into the tubes of the Composing Machine.

The general arrangement of the Magnetical and Electrical Instruments, so far as there is any, is as follows:—Historical instruments in the central cases, terrestrial magnetism at the south end, telegraphic apparatus on wall tables to the right, electrical apparatus to the left.

In magnetism pure the Teyler Institution at Haarlem contributes one of the largest natural magnets in the world; and M. Jamin has sent over one of his, by which he demonstrates the greater holding power obtained when the magnet is built up of fine laminæ. In terrestrial magnetism are historical dip circles and original recording instruments, as well as many useful for magnetic surveys. Dr. Vogel, of the Sun Observatory, of Berlin, has allowed his complete magnetic equipment made by Adie to remain in this country during the exhibition, and it is now being erected near the lighthouse. The subtle laboratory results of Ampère on the attractive and repulsive influences of voltaic currents upon themselves when passing through metallic conductors in the same or opposite directions; the delicate elaboration by Oersted in 1819 of the directive influence upon a suspended magnetic needle of voltaic currents passed in a direction parallel to its axis, the development of this by Gauss and Weber in 1833; the work of Soemmering in 1809, who first used currents from the Voltaic pile for telegraphic purposes; of Steinheil, who discovered in 1836 the practicability of using the earth as the return circuit; of Seebeck, of Berlin, in 1821, on thermo-electric currents; and the labours and discoveries of Faraday and Wheatstone as regards magneto-electricity and the laws that regulate the transmission of electric currents through metallic conductors, with their practical application to the transmission of intelligence to distant parts, are all brought before us. The chief interest of the collection in this department, as in others, culminates in the original apparatus. In magnetism, the original apparatus of Faraday which he employed in his experimental researches in the magnetic and diamagnetic character of gasses, and in his researches upon the polarity of diamagnetic force, are of great interest. The series of voltaic current generators comprise, among others, the original elements which were employed by Daniell, Wollaston, Sturgeon, and Grove in their researches. Some of the earlier forms of the magneto-electric machines by Wheatstone are contributed from the physical apparatus collection belonging to King's College, London. From the same collection is the original apparatus by which Prof. Wheatstone determined the velocity and duration of the electric spark by means of a rapidly revolving mirror, and the elongation of the electric spark discharged through a wire half a mile in length, giving an estimated velocity of 288,000 miles in a second. A wonderful series illustrating the evolution of the electrometer contributed be Sir William Thomson must not be passed over.

The historical collections of telegraphic instruments are of great extent. Here is the original five-needle telegraph of Cooke and Wheatstone, 1838, with its large lozenge-shape cumbersome dial, and heavy pointers indicating the letters by the convergence respectively of two of the needles, and we here also find the first attempt at the insulation of underground wires, the five metallic line wires required to carry the singles being inserted in grooves cut longitudinally in triangular pieces of wood, and filled in with a resinous cement, and laid underground. Here are also the first electric key and relay instrument constructed by Wheatstone, and Cooke's and Wheatstone's early letter dial telegraph of 1840. Passing along the collection sent by her Majesty's Postmaster-General, the attention is arrested by two large double-needle instruments in heavy mahogany cases, bearing brass inscription plates at their base. These two instruments, contributed by Messrs. Reid Brothers, were the means of bringing to justice Tawell, the murderer, and the *Times* of that date, 1844, observed that "had it not been for the efficient aid of the electric telegraph, both at the Paddington and Slough Stations, the greatest difficulty, as well as delay, would have been occasioned in the apprehension of the prisoner." The Henley magneto machine, or "thunder pump," has likewise an interest as marking a epoch. The series of coils and needles employed in telegraph apparatus shows the advance made by Holmes in 1848 from the slow pendulous motion of the Cooke and Wheatstone long 5-inch astatic needle combination. Equally instructive is the display of insulators; it must not be forgotten that the early line wires were at times insulated with goose quills. Special attention should also be directed to two early forms of apparatus, which have been the models upon which have been built two of the most valuable and important of modern telegraph apparatus. The first is that of Gauss and Weber's telegraph (1833), contributed by the German Telegraph Department. In this signal indicating apparatus motion is given to a bar-magnet, suspended by a fine wire, by means of the directive influence of a multiplying coil of wire surrounding it, and in the centre of which the bar can oscillate freely. A mirror is attached to the axis of rotation of the magnetic bar, so that if the bar turns to the right or left the mirror moves with it. The second early form of apparatus to which attention is directed is that of Sykes Ward's telegraph, 1847, in which signals are indicated by the deflection of electro-dynamic coils. free to vibrate over the poles of a permanent magnet. It will be observed that the motor power in Sir William Thomson's syphon recording telegraph is obtained by the motion of a delicately suspended helix of wire vibrating over a soft iron core placed between the poles of a powerful magnet, the motion of this coil being imparted to the delicate marker or capillary tube, which registers the signals upon the advancing paper riband. The early chemical printing telegraph of Alexander Bain, 1846 (incomplete), with its cumbersome wooden box and governor arrangement, also marks an era. In the collection of modern recording telegraphs, the high speed automatic printing instruments of Wheatstone and the syphon recorder of Sir William Thomson are the most interesting.

Mr. Culley is to be congratulated on the completeness of our Post Office display, and the exhibition of the German Telegraph Department forms a very complete historical collection of apparatus, from the beginning, to the recently made ingenious contrivances of Messrs. Siemens and Halske, of Berlin. Of the ancient telegraphic apparatus, of which the originals are not sent, such as Gauss and Weber's or Steinteil's apparatus, copies have been forwarded so exactly made that even spots of rust are represented. The automatic Morse recorders and letter-showing telegraphs of Messrs. Siemens deserve most careful study. The automatic Morse cylinder transmitter is comparatively new to this country, and combines three important elements in its construction; it composes and transmits the messages automatically by means of a single apparatus, the sending of the message being accomplished by the depression of finger-keys corresponding to the letters required, and it possesses great rapidity, transmitting upwards of 90 messages an hour of the ordinary length. The most important forms of magneto current generators for producing the electric light are well represented.

The original collections of apparatus contain objects which many will be glad to see—the apparatus with which Faraday obtained the magneto-electric spark and his apparatus for magneto-electric induction, also a portion of the battery used by Sir Humphrey Davy in decomposing the alkalies, and much of De la Rives's apparatus used by him both in his researches on passage of the induced current through rarefied gases, and first experiments in galvanic gilding.

Leaving the gallery where are exhibited the electrical and magnetic instruments, we come into that containing the geometrical models and instruments. For the purpose of exhibition these have generally been divided into instruments used in geometrical drawing, those used in tracing special curves, and models and drawings of figures in space. Of the first of these Mr. Stanley, of Great Turnstile, High Holborn, has sent for exhibition a very complete and perfect collection, containing every instrument which can possibly be used by the engineering, mechanical, or architectural draughtsman. In this Department is exhibited a collection of ancient mathematical instruments, lent by the Prince of Pless, from his antiquarian museum at Schloss Fürstenstein in Silesia. It is interesting for its completeness as well as for the beauty of workmanship and finish of the instruments, though they date from the beginning of the last century. There are also several beautiful pantographs—instruments, that is, for copying on a reduced or enlarged scale any plane figure—from France and Germany. One of these, by Messrs. Breithaupt and Son, of Cassel, has tubular arms, instead of bars, giving strength and lightness to the whole; but the most perfect and complete instrument is one made by M. Gavard, of Paris, for our own India Office.

Linkages, to which great attention has been recently given, are led off by the compound compass of Colonel Peaucillier, who was the first to show that a straight line can be accurately described by a combination of links; the discoveries of Professor Sylvester and of Mr. Kempe, in the same direction, are also beautifully illustrated by a series of linkage movements contributed by the latter gentleman. For the more complicated curves there are the conograph and cycloidograph of Dr. Zmursko, of Lemberg, Mr. A. G. Donkin's original model of a machine for producing different forms of a harmonic curve—that is, a curve produced by the combination of two motions, or, more properly, oscillations at right angles to each other, and Messrs. Tisley and Spiller's more perfect form of the same instrument. Messrs. Tisley and Spiller and Professor Knoblauch, of the University of Halle, show instruments which, though differing in appearance, produce the curves by means of a pen connected with two pendulums swinging in planes at different angles to each other.

Of the models of figures in space there is a most interesting and extensive collection. The remaining half of the gallery in which the geometrical models are exhibited is occupied by a remarkable collection of kinematical models from the Royal Gewerbe-Academie of Berlin.

The next section to which we come in this gallery is that of Arithmetic, which, as we have already stated, will be found the first in the Catalogue. Of the instruments calculating by machine work the most perfect example will be found in the late Mr. Babbage's calculating machine, or, as he more appropriately called it, difference engine. The Conservatoire des Arts et Métiers at Paris has sent Pascal's calculating machine, bearing date 1642, and the Royal Gewerbe-Academie at Berlin one formerly the property of the celebrated alchemist and charlatan, Hofrath Beyreis. The most notable modern machine of this kind is the tide calculating machine, exhibited by Sir W. Thompson. This is an embodiment of the idea of Laplace, that the height of the water at any moment might be expressed by the sum of functions of certain periods of the sun and moon's mean motions, and of the inequalities of these motions, due to the ellipticity of the orbits of the earth and moon, and of their varying inclinations to the earth's equator. The machine consists of a triangular plate suspended on pivots at its apex and near the middle of its base. Arranged along its two sides are ten pulleys with wheel work behind, which are made to turn relatively to each other, each in its own proper period. The main driving shaft is fitted along the base of the triangular plate, and gives motion to each of the pulleys by means of endless screws. A fine steel chain passes alternately over the upper and lower pulleys, and is fixed at the apex of the plate. Attached to the free end of the chain is an ink bottle with a glass point, which is in contact with the revolving barrel. The pulleys are capable of being thrown out from their respective centres in order to give the range of tide for the place for which the machime is for the time set. For each change of this kind when the instrument is in action the pen lies at a different height on the barrel, so that a curve is traced different for each different position of the pulleys. The tide ranges and the time at which each is at its *maximum* have first to be determined, and have occupied the labours of one of the committees of the British Association for some years. Tidal constants have been determined and are available for prediction by this machine for the following places:—In England—Liverpool, Helbre Island (mouth of the river Dee), West Hartlepool, Portland Breakwater. In the United States—Fort Point (San Francisco), San Diego, Fort Clinch, and Cat Island; and in India, for Bombay, Kurraachee, and Tuticorin. The constants are now being determined for Brest and Toulon. The machine was constructed under the superintendence of Mr. E. Roberts, of the Nautical Almanac office, by Messrs. A. Légé and Co., of Hatton-garden. The practical result of the use of this instrument, as stated by Professor Smith in the handbook, is that "a single operator is enabled to find in an hour or two, by the comparison of actual and harmonic tidal waves, any one of the simple harmonic elements of a year's tides, recorded in waves by an ordinary tide-gauge in the usual manner—a result which hitherto has required not less than twenty hours' computation by skilled arithmeticians."

THE CONSTRUCTION OF RAILWAY WAGGONS.

By Mr. W. R. Browne, Assoc. Inst. C.E.

The designing of a waggon has its peculiar difficulties, because in addition to ordinary strains, which could be calculated and allowed for, it was also subject to sudden and extraordinary strains, which defied calculation. It is not, therefore, herein attempted to give a complete theoretical investigation of strains in this case, or to frame a design and dimensions based on theoretical principles. The dimensions found in the practice of the leading British railways had been assumed as substantially correct. What has been aimed at is the comparison of these with one another, checking them also by theory whenever possible, and so endeavouring to arrive at the lightest and most economical design, consistent with the practical conditions of the case.

In considering the subject, the principle, then is, that the strength of a waggon was not fixed, as in other structures, by the load it had to carry. It would therefore appear that the proper plan was to load a waggon as heavily as possible; and this brought to view the first point for enquiry, viz., what was the best load for a waggon? The early waggons only carried 3 or 4 tons, and weighed as much, or more; the load was gradually increased to 6 tons, and then to 8 and 10 tons, where it had stopped; although still the waggon was too strong for its load. There were yet many 6-ton waggons running, but few were now built—at least by railway companies; in fact, their tare, weight, and cost were not much less than that of a 10-ton waggon, while their load was little more than one-half. Thus the question was practically narrowed to 8 and 10-ton waggons. The difference in weight and cost of these was not great. It would seem, then, as though the 10-ton was decidedly the proper type, and that, as even here the factor of safety was far too high, a yet greater load might be resorted to. There were, however, two reasons against this: first, waggons had to be shifted on sidings and in yards by horse power, and it was obviously undesirable that a waggon should be too heavy for a single horse to start it; secondly, it was comparatively seldom that a waggon was loaded to its full capacity. This question had been treated for French railways by M. Marché; for English railways there were no corresponding statistics. But looking to figures, and remembering that if a 10-ton waggon were not loaded up to 8 tons, its extra weight and cost were absolutely wasted, it would appear that for general traffic the best load was probably 8 tons.

Special classes of waggons—light waggons for light traffic, and *vice versâ*—had often been advocated, but there were two fatal objections: first, the light waggon might get a heavy load for its return journey; secondly, it might be put among a number of heavy waggons, and hence have to bear the same shocks, from which it would suffer more. The writer on the contrary thinks the aim should be to make all waggons precisely similar, and their parts interchangeable, which would result in a great advantage in repairs.

A waggon might be divided into its parts thus: A, wheels and axles; B, axleboxes; C, springs; D, underframe &c.; E, draw-gear; F, buffers; and G, body.

A, wheels and axles.—The forces formed a couple, which produced the same breaking strain on every point of the axle. Why, then, was the wheel seat larger than either the journal or the centre? The axle, of course, broke under a blow, given, say, by an obstruction on the line; but in the journal the shock was taken off by the spring, which lessened the effect there. Again, the axle was in the position of a beam fixed at one end and struck at the other. The greatest strain would, therefore, be at the fixed end, or close to the undisturbed wheel, and it would always be less in the middle than at one end. This accounted for the fact, that axles generally broke just inside the wheel seat; hence, shoulders were objectionable, and probably also the great pressures now used in forcing on the wheels. The simplest form of wheel was the American chilled wheel. This might be made from Swedish or Lorne pig. In the ordinary form the difficulty lay in fastening the tyres. The question of riveted tyres was discussed, and it was pointed out that riveted tyres might now be had at a very slight increase in cost. Wooden wheels get rid of the skeleton, the tyre being put direct on to the wooden body; the weight was less than iron wheels, the cost was about the same, and their elasticity appeared to have great effect in preventing the breakage of axles.

B. Axleboxes.—The main question here was as to oil or grease lubrication. The advantage of grease was that it was cheap in first cost and readily applied; the axleboxes were also lighter and less expensive. On the other hand oil gave much less trouble in lubricating, and less risk of hot boxes, while the tractive force required was less. Axle-guards of 2½ inches by ¾ inch crowns and 2¼ inches by ¾ inch wings were quite strong enough; in many specifications these dimensions were excessive.

C. Springs.—No alteration was likely to be made in the form of springs. Their strength was only the sum of the strengths of the plates, as they acted independently; hence for strength and lightness the plates should be few and deep; perhaps the tendency was now too much in the other direction.

D. Underframe.—No great improvement was probable in the disposition of the material in wooden underframes; but the diagonals should always incline from the centre towards the buffers. The disadvantage of wood was that it only acted as a strut, not as a tie; hence tie rods were necessary. A combination of iron and wood might seem preferable, but such combinations were rarely successful. Wood was, however, shown by comparison to be much lighter and cheaper than iron; the only advantage of the latter was durability, and this in railway waggons was not of first-class importance. The usual scantling in wood was now 12 inches by 5 inches. This might be reduced for sole bars, headstocks, and middle bearers.

E. Draw-gear.—The advantage of this being continuous was, that it diminished the strain on the waggon-body; the disadvantage was the extra weight and cost, as the draw-bars did nothing to assist the under-frame. This might be overcome by a new design, in which the tie-rods acted as draw-bars, so that if one broke the rest would still hold; and there was no weld in the draw-bar.

F. Buffers.—The tendency was to do away with spring buffers, at least in coal waggons; they were at a great disadvantage where most of the stock had dead buffers only. For the more expensive class of waggons wrought-iron buffers seemed to be superseding cast-iron.

G. Body.—Short waggons were desirable rather than long waggons, because (a) they were cheaper and lighter, saving much in timber, (b) they were handier in themselves and in shunting, and made trains shorter, and (c) they prevented the sole bars from "hogging" by diminishing the overhang. The thickness of the planking, which was now 2½ inches or 3 inches might be reduced to 2 inches if the capping-irons were fastened to the corner plates, so as to make a sort of iron-bound frame.

It is believed that a waggon built as suggested would weigh about 3 tons 18 cwt., while the 8-ton waggons now running on the principal railways weighed from 4 tons 8 cwt. to 5 tons 10 cwt.—*Abridgement of Paper recently read at the Institution of Civil Engineers.*

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Thursday, June 8th.—Exposition of Inventions at ½ past 8 o'clock p.m.

TO MEMBERS OF COUNCIL.

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F. W. Campin, Sec.

Proceedings of the Institute.

At the Members' Meeting of the Institute on 11th May, Admiral Selwyn, V.P., in the chair, there was a Conference on the Patent Question, when the petition to the House of Commons, settled by the Committee appointed at the Public Conference at the hall of the Society of Arts on 25th April last, was reported to the meeting, and met with unanimous approval. This petition is given *in extenso* in our first article in the present number. Mr. R. Bevan's invention of improvements in obtaining and applying motive power was exhibited and explained, and after some discussion the thanks of the meeting to Mr. Bevan for his interesting paper were unanimously voted.

On the 25th of May there were meetings of the Executive Council and the General Council, at which the Annual Report was settled, and afterwards the Annual General Meeting assembled, when the Report was read and adopted. Sir Antonio Brady was elected President of the Institute. The former Vice-Presidents, with the addition of Henry Bessemer, Esq., and C. W. Siemens, Esq., were elected as Vice-Presidents. The former General Council as also one-third of the Executive Council were elected as the new Executive Council, and Mr. F. W. Campin was re-elected Secretary; but we are compelled to postpone our report. Further, in our advertised list we are obliged to postpone complete correction until our next.

Monthly Notices.

The Challenger has just arrived home from her three years' interestering cruise, and is now at Portsmouth. In his last report to the Hydrographer of the Admiralty (says the *Athenæum*), Prof. Wyville Thomson discusses the question of oceanic circulation, and shows reason for believing that the bottom water of the two great oceans is an extremely slow indraught from the Southern Sea. And this indraught he refers to the simplest and most obvious of all causes—the excess of evaporation over precipitation in the northern portion of the land hemisphere; and the excess of precipitation over evaporation in the middle and southern part of the water hemisphere. And in concluding his report, Prof. Thomson says further, "I need scarcely add, that I have never seen, whether in the Atlantic, the Southern Sea, or the Pacific, the slightest ground for supposing that such a thing exists as a general vertical circulation of the water of the ocean depending upon differences of specific gravity."

The Conversazione of the Institution of Civil Engineers, given by Mr. G. R. Stephenson, the President, will take place on Thursday, the 1st of June (this day), in the Galleries containing the Loan Collection of Scientific Apparatus, at South Kensington.

Magnesilyne or Magnesium-Citrate, a new medicinal preparation, manufactured by Kinmond and Co., of Leamington, is, we hear, being brought into extensive use. According to Professor Attfield, it contains an amount of carbonate of magnesium and of citric acid corresponding to 60 per cent. of ordinary crystallized citrate of magnesium. The other ingredients are citric acid, bicarbonate of sodium, and sugar. The powder dissolves in water with brisk effervescence, yielding a clear liquid, having an agreeable faintly acidulous flavour. The medical journals speak of this preparation in very favourable terms.

M. Weyprecht, the chief of the second Austrian expedition to the North Pole, has reported on the relation between the Aurora Borealis and the magnetic perturbations. He states that he found, in regions where the aurora exhibited its maximum power, the deviation of the magnetic needle was towards the east. The declination diminished, but always the inclination increased.

Prof. Challis's paper, read before the Victoria Institute on Monday, the 1st ult., was both elaborate and interesting. The principal point in it was to call attention to the fact that Galileo's theorem, as it has been called, of the parabolic motion of a projectile became known, and could only be known, by experiment; and that although, by combining it with the law of gravitation, Newton and his successors have been able to explain all the planetary movements, yet when we pass back in the line of causation from physics to metaphysics, it becomes impossible to explain any motion without the intervention of *conscious* effort.

On the 17*th of April* the Spring Meeting of the Smithsonian Institute was held in Washington. Many valuable scientific communications were made. Prof. Henry, President of the Academy, stated that it was contemplated to conduct, at the cost of the Smithsonian Institute, a series of experiments and observations to determine accurately the rate of increase of the Earth's temperature at progressive depths. The work of weighing the Earth accurately will also be undertaken.

M. Lecoq de Boisbaudran states, in the *Comptes Rendus*, that he has reduced to the metallic state about ten centigrams of the new metal, "gallium." This has enabled him to determine that pure gallium melts at 29° 5′ Cent. When once solidified, the metal is hard, even at a temperature a little below its melting-point. Melted gallium adheres readily to glass, forming a mirror whiter than that produced by mercury.

Purification of Sulphide of Carbon, with mercury salts, is, according to the *Scientific American*, by S. Kern, superseded by nitrate of lead, pulverized and mixed with a little metallic lead. The bisulphide is shaken with fresh quantities of the salt as long as it continues to blacken it; then it is decanted and distilled. The affinity of lead for sulphuretted hydrogen and sulphur in general leads us to believe that Mr. Kern's method will prove a good one. Strips of bright metallic copper will also soon remove the colour and much of the odour from bisulphide of carbon. Unfortunately exposure to light causes both odour and colour to return.

Proceedings of Societies.

ROYAL SOCIETY.

APRIL 27TH.—Dr. Hooker, C.B., President, in the chair.—The Bakerian lecture "On the Gaseous State of Matter" was delivered by Dr. Andrews, of Belfast.

May 4th.—Captain Evans, C.B., V.P., in the chair.—The following papers were read: "Supplementary Note on the Theory of Ventilation," by Dr. François de Chaumont.—"On the Effects of Heat on the Chloride Bromide and Iodide of Silver," "On the Effects of Heat on some Chlorobromiodides of Silver," by Mr. G. F. Rodwell,—"On the Absorption Spectra of Bromine and Iodine Monochloride," by Messrs. H. E. Roscoe and T. E. Thorpe,—"On the Origin of Windings of Rivers in Alluvial Plains, with Remarks on the Flow of Water round Bends in Pipes," by Prof. J. Thomson,—and "On the Modification of the Excitability of Motor Nerves produced by Injury," by Mr. G. J. Romanes.

May 11th.—Dr. Günther, M.A., V.P., in the chair.—The following papers were read: "On some Thallophytes Parasitic within recent Madreporaria," by Prof. Duncan,—"On the Calculation of the Trajectories of Shot," by Mr. W. D. Niven,—"Condensation of Vapour of Mercury on Selenium in the Sprengal Vacuum," by Mr. R. J. Moss,—"On Clairautian Functions and Equations," by Col. Cunningham,—and "On Simultaneous Variations of the Barometer in India," by Mr. J. A. Broun.

May 18th.—Dr. Hooker, C.B., President, in the chair.—The following papers were read: On the Polarization of Light by Crystals of Iodine," and "Absorption Spectra of Iodine," by Sir John Conroy,—"On Picro-rocellin," by Dr. Stenhouse and Mr. C. E. Groves,—"Observations on Stratified Discharges by means of a Revolving Mirror," by Mr. W. Spottiswoode,—"Note on a Simultaneous Disturbance of the Barometer and of the Magnetic Needle," by Rev. S. J. Perry,—"On the Organization of the Fossil Plants of the Coal Measures, Part VIII. Ferns (*continued*), and Gymnospermous Stems and Seeds," by Prof. W. C. Williamson, and "The Calculus of Chemical Operations, being a Method for the Investigation, by means of Symbols, of the Laws of the Distribution of Weight in Chemical Change, Part II. On the Analysis of Chemical Events," by Sir B. C. Brodie.

ROYAL INSTITUTION.

MAY 1ST.—Annual Meeting.—G. Busk, Esq., Treasurer and V.P., in the chair.—The Annual Report of the Committee of Visitors for the year 1875, testifying to the continued prosperity and efficient management of the Institution, was read and adopted. The Stock sold out to rebuild and furnish the Laboratories has been more than replaced. Fifty-six new Members were elected in 1875. Sixty-one lectures and nineteen evening discourses were delivered in 1875. The books and pamphlets presented in 1875 amounted to about 155 volumes, making, with those purchased by the managers, a total of 323 volumes added to the library in the year, exclusive of periodicals. The following gentlemen were elected as officers for the ensuing year: President, the Duke of Northumberland; Treasurer, G. Busk, Esq.; Secretary, W. Spottiswoode, Esq.; Managers, G. Berkley, W. Bowman, Sir B. C. Brodie, Bart., Admiral Sir H. J. Codrington, Right Hon. J. G. Dodson, Sir T. F. Elliot, Lieut.-Col. J. A. Grant, C. H. Hawkins, Dr. J. D. Hooker, A. Latham, Dr. R. Liebreich, the Lord Lindsay, W. Pole, Sir W. F. Pollock, Bart., and Dr. C. W. Siemens; Visitors, J. R. Andrews, Dr. T. Boycott, J. C. Burgoyne, R. P. Linton, W. W. Lloyd, W. Longman, Col. W. Pinney, W. S. Portal, Dr. J. Rae, Rev. A. Rigg, Rev. W. Rogers, J. B. Sedgwick, B. W. Smith, B. L. Smith, and J. Spedding.

May 8th.—G. Busk, Esq., Treasurer and V.P., in the chair.—The following Vice-Presidents for the ensuing year were announced: Sir T. F. Elliot, Sir W. F. Pollock, Dr. J. Hooker, G. Busk, Esq., and Dr. W. Spottiswoode. Hon. G. Elliot, Major T. M. Sandys, Messrs. E. H. Gould, C. R. Lucas, and E. W. Stanton were elected Members. Prof. Tyndall was re-elected Professor of Natural Philosophy.

ZOOLOGICAL SOCIETY.

MAY 2ND.—Rob. Hudson, Esq., F.R.S., V.P., in the chair.—The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of April, 1876, and called particular attention to a collection of Angolan animals, presented to the Society by Lieut. V. R. Cameron, the celebrated African traveller. Lieut. Cameron had also brought with him two Chestnut-backed Colies from the river Daude, presented to the Society by Henry C. Tait, Esq., C.M.Z.S. Two young Cassowaries, from Duke of York Island, presented by the Rev. George Brown, C.M.Z.S., had also been received. Some other birds sent home by Mr. Brown had died on the passage. Mr. G. Dawson Rowley, F.Z.S., exhibited and made remarks on a specimen of *Machœrirhynchus nigripectus*, from New Guinea, believed to be the first example of this rare bird which had reached this country. Extracts were read from several letters received from Dr. George Bennett, F.Z.S., giving some account of the proceedings of Mr. L. M. D'Albertis, C.M.Z.S., and of his recent expedition up the Fly River in December, 1875. Mr. J. H. Gurney, Junr., exhibited and made remarks on an example of the Lesser White-fronted Goose, from Egypt, being the first record of the occurrence of this species in Africa. Mr. Osbert Salvin, F.R.S. exhibited and made remarks on a piece of a pine from Guatemala, which had been perforated by a Woodpecker (*Melanerpes formicivorus*), for the purpose of storing acorns. Mr. A. Grote, F.Z.S., exhibited and made remarks on Colonel Gordon's drawing of *Ovis polii*, which was the original of the figure given in the Society's "Proceedings" for 1874. Mr. George Busk, F.R.S., read a memoir on the Ancient or Quaternary Fauna of Gibraltar, as exemplified in the Mammalian remains of the ossiferous breccia, which occurs in the caves and fissures recently explored in different parts of the rock. Mr. Busk, after a preliminary description of the geological features of the rock and its fossiliferous caverns and fissures, treated specially of the various bones of the bear, cat, horse, rhinoceros, stag, ibex, and other animals, of which the remains occur there, and proceeded to refer them to the species to which they seemed to belong. Professor A. H. Garrod read a paper on the anatomy of the Colies (*Colius*), which he regarded as belonging to Piciform group of the division of anomalogonatous birds according to his arrangement, but constituting an independent family. A communication was read from Mr. E. Layard, F.Z.S., containing the description of a new Blackbird (*Turdus*), from Taviuni, one of the Fiji Islands. The Rev. Canon Tristram read a note on the occurrence of the Roebuck in Palestine.

PHYSICAL SOCIETY.

APRIL 29TH.—Prof. Gladstone, V.P., in the chair. The following gentlemen were elected Members.—Prof. F. Fuller and Capt. E. H. White.—The Secretary read a communication from Sir J. Conroy, Bart., "On a Simple Form of Heliostat." Mr. S. P. Thompson made a second communication "On the so-called "Etheric Force," and described some experiments which he has recently made in the Physical Laboratory at South Kensington on the subject. The name was given by Mr. Edison, the inventor of the motograph, to the sparks obtained when a conductor is presented to the core of an electro-magnet, the coils of which are traversed by an intermittent current. The results of the experiments, conducted as originally described, not proving satisfactory, various other arrangements were tried, and it was found that if the secondary current from an induction coil be used, instead of a current direct from the battery, the effects are much more marked. When the induced spark was thus diverted either wholly or partially into a short coil, which was insulated very perfectly from the core inside, a spark about half an inch in length, which had a decided effect on the nerves, could be drawn off from the core, and this was sufficient to illuminate a small vacuum tube. The spark, however, does not exhibit the usual signs of polarity. It was shown, by observing the illumination thus produced with a rotating mirror, that the discharge is in reality a reciprocating one, each spark returning on its path after a minute interval of time. Under certain conditions it is also possible to charge an electroscope either positively or negatively by means of the spark, and Mr. Thompson has shown that the spark ignites a jet of gas, but fails to deflagrate metallic wire or ignite gunpowder. From the above and other experiments, which will be exhibited on a future occasion, the author concludes that the cause of the phenomena is obvious, and that the hypothesis of a new force is unnecessary. Prof. M'Leod referred to a paper on the same subject, which appeared in the *Chemical News* of the 28th of April, by Messrs. Houston and Thomson.

May 13th.—Prof. G. C. Foster, President, in the chair.—The following candidates were elected Members: Prof. T. Andrews, Rev. R. H. M. Bosanquet, and Mr. D. Howard.—Mr. Thompson concluded the communication on the supposed new force, which he commenced at the last meeting. In the arrangement which he has adopted for obtaining the spark, the secondary current of a Rhumkorff's soil is made to traverse a short coil of wire, which is thoroughly insulated from the internal core, and into the circuit an arrangement is introduced by means of which the spark may be made to traverse a variable thickness of air in its course round the short coil. It is found that if this spark is very short the spark obtained from the internal core is also short, but as we increase the thickness of air to be traversed the spark which may be drawn off increases; the greatest effect, however, is produced when one terminal of the coil is connected with the earth, the spark then obtained being about half an inch in diameter. Mr. Edison considered that the spark was retroactive, but Mr. Thompson showed by an experiment that deficient insulation might lead to such a conclusion. He then proceeded to show that just as the charge given to a gold-leaf electroscope is at times positive and at times negative, without any apparent reason for the change, so if the core of the arrangement employed be connected with a Thomson's galvanometer the needle will be found to wander irregularly about the scale on both sides of the zero. In order to show that these experiments are identical with those conducted as originally described by the discoverer, the terminals of the induction-coil were connected with the coil of an electro-magnet, the same means of including a layer of air in the circuit being introduced. The effect in this case was found to be precisely similar to that obtained with the special arrangement previously used; with a brush discharge a Geissler's tube could be illuminated, and, when the layer of air was infinitesimal, the spark produced was also infinitesimal. It was then shown that, if the spark at the point of contact in the key, when a direct battery current traverses the coil, be done away with, by shunting the extra current which gives rise to it, no spark can be obtained from the core. It thus appears that no spark is obtained when there is no necessity for an inducing current to accumulate until it has sufficient tension to leap over a resisting medium, and that as the thickness of this resisting medium increases, the spark obtained becomes greater. Evidently on these occasions the current has time to attract unlike, and repel like, electricity in the core, and, if a conductor in connection with the earth be presented to this core, the like electricity will escape: hence a spark will result. As soon, however, as the tension has become sufficient to leap over the layer of air, it will be necessary to restore equilibrium in the core. Hence there will be a return spark in the opposite direction. From these experiments it will be seen that the phenomena observed may be explained by the ordinary laws of induction.

LINNEAN SOCIETY.

APRIL 20TH.—G. Bentham, V.P., in the chair.—A note addressed to Dr. Hooker from Dr. Kirk, H.M. Consul at Zanzibar, was read. It contained proofs of the identity of the living Copal-tree (*Trachylobium Hornemannianum*) with that which yielded the Zanzibar copal, or gum "Animi," now found in the earth on the east cost of Africa, and often where no copal-yielding tree now exists. Specimens of leaf, flower, &c., obtained in the semi-fossil gum agree in all respects with those of the living tree. The peculiar and more valuable properties of the buried gum Animi he attributes to a chemical action, the result of long resting in the soil. Mr. W. P. Hiern read a paper "On the African Species of the genus Coffea, Linn." This genus as now restricted belongs to the Old World, the supposed American species being referred to other groups. Out of seven Indian species, one formerly was cultivated, but has been superseded by the African plants. Of the latter, the author distinguishes fifteen species. Thirteen are indigenous to the African continent, and two to Mauritius. In West Africa there are eleven, and in Central and East Africa two kinds: others may yet be discovered as exploration proceeds. The ordinary Coffee of commerce, *C. Arabica*, is by no means confined to Arabia, but grows wild in Abyssinia, near the Victoria Nyanza, and has been found by Welwitsch in Angola. The latter describes it as a small tree ten to fifteen feet high, with a trunk a foot in diameter. The commercial varieties of the coffee berry depend on shape, size, and colour. Shape, it seems, is related to the particular portion of the plant on which the seed grows; size and succulence correspond to the nature of the locality; and colour has reference to the degree of maturity attained by the fruit at the time of gathering. The famous Mocha coffee Mr. Hiern regards as a doubtful variety, due, probably, to a particular treatment and cultivation. The Mocha now seems likely to be outstripped by an African rival. This, the Liberian coffee, (*C. Liberica*), was introduced into England in 1874 by Mr. W. Bull, the horticulturist. It is a large-leaved and large-berried plant, far superior in flavour and aroma to that in ordinary use. Moreover, it is very robust, hardy, and exceedingly productive, so much so that the Ceylon planters, according to Mr. Bull, who has sent it there, affirm its value is several times greater than that of the *C. Arabica* commonly cultivated. This Liberian coffee seems moreover to grow and flourish at a lower altitude than the other, and thus will probably thrive and spread in districts uncongenial to the other. It is likely also to withstand the ravages of a fungus at present destroying the older-known kind. In short, its qualities are of a most valuable kind, commercially and otherwise, so that there is a prospect of its coming into extensive repute when better known. (Those interested in African products and commerce would do well to make themselves acquainted with this Liberian coffee.) Mr. Thiselton-Dyer read a note "On the Plant yielding Latakia Tobacco." He infers that this is produced by a different species from the Turkish, and that, as imported into this country, it consists of the flowering twigs made up into bundles which have been smoked with pine wood. "On the Classification of Narcissus," by Mr. Shirley Hibberd,—"Polynesian Algæ," by Prof. Dickie,—and "New Freshwater Algæ from Kerguelen Island," by Mr. P. F. Reinsch, were three papers submitted to the Society.

May 4th.—G. Bentham, Vice-President, in the chair.—Messrs. G. D. Rowley and G. H. Parkes were elected Fellows, and two Foreign Members were balloted for. Skins of the young of the Arctic Fox, part of a litter of six, supposed to have been the produce of two vixens, were exhibited by Mr. W. D. Crotch. A photograph of remarkable example of Fasciated Inflorescence occurring in *Fourcroya Cubensis* was shown by Mr. H. Trimen. The specimen was said to have been six and a half feet high and four feet wide. A curious parasitic Fungoid growth on a Beetle-larva, from Australia, exhibited by Mr. B. Shillitoe, excited some interest. The exceedingly diminutive eye, evincing next to total blindness, of the Indian river-whale, *Plataristu gangetica*, and some grasses obtained in the stomach of this cetacean, were shown in behalf of Dr. J. Anderson. A paper, "On Trematoda from Gangetic Dolphins," was read by Dr. Cobbold. *Distoma lancea*, *D. campula*, and *D. Andersoni* were three sorts found. The last is new; the others, only once met with before, now, after forty and and twenty years, turn up thousands of miles distant from where previously obtained, and in very different forms of cetacea. The rare, though interesting African genus of plants Hoodia has received elucidation through the researches of Mr. W. T. Thiselton-Dyer, who read a communication upon them. He distinguished and describes three species, *H. Gordoni*, *H. Currori*, and *H. Barklyi*, and shows Hoodia in the structure of its floral envelope assimilates to the genus Decabelore. Mr. W. D. Crotch read a paper, "On the Migration and Habits of the Norwegian Lemming." The Rev. M. J. Berkeley communicated a "Report on the Fungi collected in Kerguelen Island during the stay of the Transit of Venus Expedition, 1874-5." This section of the cryptogamic Flora of the island appears to be poorly represented so far as numbers of species are concerned. A "Note on *Arctomys dichrous*," an oddly-coloured kind of marmot, inhabiting Cabul, by Dr. J. Anderson, was announced.

GEOGRAPHICAL SOCIETY.

MAY 8TH.—Major-General Sir H. C. Rawlinson, President, in the chair.—The following gentlemen were elected Fellows: Lieut.-Gen. J. Travers, Col. E. L. M. Evans, Lieut.-Col. S. Ferris, Major F. Mullener, Capt. W. B. Pauli; Messrs. H. L. Arbuthnot, J. Bateman, J. Elies, J. S. Forbes, P. L. Henderson, J. Hughes, H. H. Jones, H. Kay, J. Montgomery, C. M. Roberts, B. Smith, C. Trotter, and R. B. Woodd. The papers read were: "Description of the Country and Natives of the Neighbourhood of Port Moresby, New Guinea," by Mr. O. C. Stone,—"Natives and Products of the Fly River, New Guinea," by L. M. D'Albertis.

GEOLOGICAL SOCIETY.

APRIL 26TH.—Prof. P. Martin Duncan, President, in the chair.—The Rev. E. Hill was elected a Fellow, and Prof. Beyrich, of Berlin, a Foreign Member. The following communications were read: "A Translation of a Notice, by Capt. Miaulis, of the Greek Royal navy, of the Occurrence of a Submarine Crater within the Harbour of Karavossera, in the Gulf of Arta,"—"The Physical History of the Dee, Wales," by Prof. A. C. Ramsay,—and "On the Ancient Volcano of the District of Schemnitz, Hungary," by Mr. J. W. Judd.

May 10th.—Prof. P. Martin Duncan, President, in the chair.—Messrs. W. Borrer, jun., J. I'Anson, J. W. James, M. Stirrup, and C. Wilkinson were elected Fellows.—The following communications were read: "On some Fossil Reef-building Corals from the Tertiary Deposits, Tasmania,"—"On the Echinodermata of the Australian Cainozoic (Tertiary) Deposits," both by Prof. P. M. Duncan, and "On the Miocene Fossils of Haiti," by Mr. R. J. L. Guppy.

INSTITUTION OF CIVIL ENGINEERS.

APRIL 25TH.—The following papers were read: "The Dhu Heartach Lighthouse," by Mr. D. A. Stevenson,—and "On the Changes in the Tidal Portion of the River Mersey, and in its Estuary," by Mr. J. N. Shoolbred.

May 2nd.—Mr. G. R. Stephenson, President, in the chair.—The following candidates were elected: Messrs. G. H. Daglish, E. Matheson, and S. W. Yockney as Members; and Capt. C. S. Beauchamp, Lieut.-Col. A. S. Jones, Messrs. R. B. Booth, E. K. Burstal, H. Cook, J. J. Davis, H. H. D'Avigor, P. R. Emmott, R. W. H. P. Higgs, A. Izat, G. B. Lloyd, J. M'Laren, H. J. Mannering, W. Maylor, P. W. Meik, J. Richmond, A. L. Stride, H. T. S. Ward, and T. W. Woodhouse, as Associates. The council have transferred Messrs. A. F. Blandy, W. Hood, J. Kyle, and J. Steell from the class of Associates to that of Members; and have admitted Messrs. J. C. Gill, J. H. A. Ivens, G. Marston, W. Smith, and F. A. Wythes as Students of the Institution. The paper read was "On Fascine Work at the Outfalls of the Fen Rivers, and Reclamation of the Foreshore," by Mr. W. H. Wheeler.

May 9th.—Mr. W. H. Barlow, V.P., in the chair.—The papers read were: "On the Construction of Railway Waggons, with Special Reference to Economy in Dead Weight," by Mr. W. R. Browne,—and "On Railway Rolling Stock Capacity in Relation to the Dead Weight of Vehicles," by Mr. W. A. Adams, both of which appear in another column.

SOCIETY OF ENGINEERS.

MAY 1ST.—Mr. V. Pendred, President, in the chair.—The following gentlemen were elected Members: Messrs. J. Hammond, J. Morton, H. F. Packham, H. Coley, W. E. Thursfield, H. B. Sheridan, W. C. Tweney, G. Lewis, and E. V. Porter as Associates. Messrs. J. D. Lewis, H. Conradi, and H. Harris. The papers read were "On Flues and Ventilation," by Mr. A. H. C. Trewman; and "On the Ventilation of Buildings," by Mr. J. W. Pearse.

SOCIETY OF ARTS.

APRIL 20TH.—E. Chadwick, Esq., in the chair.—The paper read was "On the Sanitary Progress of India," by Capt. Galton.

April 26th.—The Duke of Manchester in the chair.—The paper read was "On Silk Culture in Australia," by Mrs. B. Neill.

May 3rd.—Prof. Duncan in the chair.—The paper read was by Mr. J. H. Collins, "On the China Clay and China Stone of Devon and Cornwall." The paper dealt principally with the methods of working and preparing the clay.

May 5th.—Mr. A. Cassels in the chair.—The paper read was "On Irrigation Works in India," by Mr. W. T. Thornton.

May 9th.—Admiral Ommanney in the chair.—The paper read was, "On the Commerce of the Gaboon," by Mr. R. B. N. Walker.

May 10th.—Mr. E. Chadwick in the chair.—The paper read was, "Spring Propulsion for Street Trams," by Mr. E. H. Leveax. The tram-cars would be driven by powerful springs, wound up at suitable points by stationary engines.

ANTHROPOLOGICAL INSTITUTE.

APRIL 25TH.—Col. A. Lane Fox, President, in the chair.—Dr. Comrie exhibited his collection of weapons and articles of domestic use from New Guinea, and added several particulars to his previous remarks.—Mr. A. Tylor read a paper "On the Origin of Numerals." He held that inventive thought had always an object-origin, and mentioned measures of length, as pace, foot, hand, &c., as having such a source. Also, in the Ptolomaic hieroglyphics, a minute or second was shown by an eye winking, answering to "the twinkling of an eye." Illustrations of the Abacus, and mode of calculating by it, were exhibited, and shown to be in principle the origin of the modern calculating machine. The dream of the universal language has been realized as far as numerals and arithmetical figures are concerned, and this is due to their origin.—A paper was read "On some apparent Coincidences of Custom and Belief in Chaldæa and other Countries," by Mr. A. L. Lewis. He alluded, amongst other points, to the works of finger-nails upon the terra-cotta deeds that had been discovered at Nineveh. They appeared to him to answer to the practice of touching the seals of legal documents with the finger. As regards the belief of the Assyrians in immortality, souls were either united with the sun or descended to "Bit-Edie." Annwn, the country of the dead, in like manner, amongst the Kymry, was situated in the lower regions, at the going down of the sun in the west. The children of Ann, or the sky, in Assyria may be compared with "Cum Anown," spirits believed in by the Kymry. Amongst the Assyrian gods, Hed answered to the Lycian deity, "Hu." Civilization appeared to originate with the Turanians, the Semitic race merely succeeding to it. The President, Mr. A. Smee, Mr. Distant, and others took part in the discussion.

May 9th.—Col. A'.Lane Fox, President, in the chair.—A paper, by Mr. Hyde Clarke, "On the Pre-historic Names of Weapons," was read. The object of the paper, which was illustrated by copious tables, was to show that the like words for arrows, dart, spear, sword, knife, axe, and hoe, were widely distributed in the languages of aborigines in Africa, Asia, Australia, and America. These represent the Pre-historic epoch. The nature and formation of the names is shown, in correspondence with the archæological evidence, by words for such weapons and tools being identical with those for stone, horn, tooth, &c.—Canon Rawlinson read a paper "On the Ethnography of the Cimbri." There were two theories respecting their origin—the one that they were Germans, the other that they were Celts. The evidence on either side was slight, and nearly balanced. The majority of the early writers favoured the Celtic view. Cæsar, who pronounced the Cimbri to be Germans, may not have met with any of pure blood. Much would depend on the meaning of the term "yellow hair." The name Cimbri has so near a resemblance to Cymry (the *b*, as in Cambria, being a usual Roman addition) that there was, perhaps, as good evidence as any on the other side in favour of the Celtic affinity of the race. A short communication from Prof. Lubach, describing the "Hunebedden," or stone monuments in Holland, was read by Mr. E. W. Braybrook.

ROYAL SOCIETY OF LITERATURE.

APRIL 19TH.—E. G. Highton, Esq., in the chair. Mr. P. Gardner read a paper "On Greek River-worship," in which he pointed out that, while the religion expressed in the *cultus* of Apollo or Dionysus had received almost more than its due share of attention from students of recent times, that connected with the veneration for rivers had been less considered than it deserved. It has been generally held that the religion of nations who worship the phenomena of nature passes through three stages. First, the most primitive Fetishism or Naturalism, the essence of which consists in a belief in the consciousness and volition of all the natural objects round man; the savage thus ascribing will to animals, trees, mountains, and the heavenly bodies: after a while, the supernatural sense grows weaker; individual trees, for instance, cease to be worshipped, and the whole wood is placed under a god: lastly, Philosophy steps in, suggesting that the popular myths are not to be taken literally, and allegory supplants the original sacred legend. Thus, we have the three stages of Naturalism, Polytheism, and Scepticism. In a well-watered country, no natural force is more impressive than that of rivers; ever changing, as it were, constantly alive, they would at once suggest the idea of a present Deity: hence we find, in the Vedas, rivers are constantly addressed as deities; and the same thing is seen among the Slavonic tribes, and in the ancient German worship of the Rhine. In Greece, the visible physical stream was supposed to possess soul and will.

April 26th.—The following gentlemen were elected Officers: Vice-Presidents, the Duke of Devonshire, the Dean of Westminster, Major-General Sir H. C. Rawlinson, H. Fox Talbot, Sir P. De Colquhoun, Sir C. Nicholson, Bart., Major-General Sir C. Dickson, Rev. C. Babington; Council, Walter de Gray Birch, Esq. (Hon. Librarian), C. H. E. Carmichael, C. Clark (Treasurer), Rev. T. M. Fuller, C. Goolden, S. G. Grady, J. Haynes, E. G. Highton, M.A., R. B. Holt, Rev. T. Hugo, C. M. Ingleby (Foreign Secretary), Dr. W. Knighton, C. H. Long, G. W. Moon, W. S. W. Vaux (Secretary), H. W. Willoughby; Auditors, E. W. Brabrook and H. Jeula.

NUMISMATIC SOCIETY.

APRIL 20TH.—J. Evans, Esq., President, in the chair.—Mr. Evans exhibited a few short-cross pennies, from a large hoard lately discovered in the neighbourhood of Le Mans, consisting in all of about 6,000 coins, chiefly French, regal and baronial. Among them were about 600 English pennies, together with some coins of William the Lion, and some Aquitaine and Poitou pieces of Richard the First. Mr. Evans remarked that the English coins in this hoard were all short-cross pennies of the types attributed by him to Henry the Second and Richard the First, no specimen being present of the type or variety attributed to John. The date of the deposit was, therefore, in Mr. Evans' opinion, not later than about A.D. 1,200. Mr. Vaux read a paper "On an Indenture preserved in the Bodleian Library at Oxford, relating to certain Farthings of James the First." Mr. Henfrey communicated a note on the Naval Medals of the Commonwealth. Major A. B. Creeke sent a notice of some unpublished varieties of English coins.

ASTRONOMICAL SOCIETY.

MAY 12TH.—W. Huggins, D.C.L., President, in the chair.—The Rev. F. Howlett presented to the Society five volumes of sun spot drawings made between the years 1859 and 1874. They contain several drawings of sun spots on a large scale, some of which have already been figured in the pages of the *Monthly Notices* and other places.—A letter was read from Birmingham, informing the Society that Dr. Schmidt's great Lunar map, of six French feet diameter, will soon be issued by the Prussian Government. It has been the labour of thirty-four years, and contains 34,000 craters, besides rills and other objects.—A paper, by Mr. Dunkin, was read, "On the Conjunction of Venus with λ Geminorum on August 18th, 1876," when there will be an excellent opportunity for making micrometrical measures of the planet's parallax with respect to the star. Its nearest approach will be seen from stations in North and South America a little before sunrise.—A paper, by Mr. Hind, was read, "On the Transit of the Great Comet of 1819 across the Sun's Disc." The transit happened on its approach to perihelion, and the comet was not observed until some days afterwards, when it was receding from the Sun. After a few weeks, Olbers calculated the elements of its orbit, and announced the fact that on the previous 26th of June it must have passed at its ascending node between the Earth and Sun. Some five years afterwards Pastorff wrote to the Baron de Zach, to inform him that he had seen the comet upon the Sun's disc, and had, upon the day of its transit, made a drawing of it, and a measure of its distance from the Sun's limb. He describes it as a nebulous body, six minutes in diameter, with a bright centre. His original drawing is preserved in the library of the Astronomical Society. Mr. Hind had carefully recalculated the elements of the comet's orbit, and had found that at the time mentioned by Pastorff the comet must have appeared much nearer to the Sun's centre than the position indicated by Pastorff. Canon Stark, of Augsburg, also published an account of a nebulous body seen upon the Sun's disc at 7h. 15m. on the morning of June 26th. The measures given by him of the position of the black spot do not agree with the position calculated by Mr. Hind, although there is less discrepancy between them and the calculated position than there is in the case of Pastorff's observation. Mr. Hind is disposed to think that neither Stark's nor Pastorff's observations are to be depended upon.—Mr. Christie read a note "On the Displacement of Lines in the Spectra of Stars," from which it appeared that the discrepancies between the results of his observations and those of Mr. Huggins only amounted, in the case of most of the stars which had been given by him, to some three or four miles per second.

METEOROLOGICAL SOCIETY.

APRIL 19TH.—Mr. H. S. Eaton, President, in the chair.—Messrs. T. H. G. Berrey, H. G. Bolam, J. Bravender, J. Holden, G. A. Hutchins, F. Jackson, T. L. Johnson, B. Latham, A. G. M'Beath, W. R. Maguire, A. S. Moss, C. Pink, J. R. Rogers, E. Toller, S. Tomlinson, W. A. M'I. Valon, H. Walker, and W. E. Woolley were elected Fellows. The following papers were read: "Velocity of the Wind at Liverpool: Tabulation of Anemometric Records," by Mr. W. W. Rundell.—"On the Aspiration of the Dry and Wet Bulb Thermometers," by Mr. S. H. Miller,—and "On the Storm which passed over the South of England on March 12, 1876," by Mr. H. Scott. The Members of the Permanent Committee of the Vienna Meteorological Congress were present, and took part in the discussion.

CHEMICAL SOICETY.

APRIL 20TH.—Prof. Andrews in the chair.—A paper, "On the Manufacture of Sulphuric Anhydride," by Dr. R. Messel and Dr. W. Squire, was read by the latter. The authors prepare the anhydride by decomposing ordinary sulphuric acid at a white heat into water, oxygen, and sulphurous anhydride, removing the water by suitable means, and then passing the mixed gases over platinized pumice heated to low redness; the oxygen and sulphurous anhydride then re-unite to form sulphuric anhydride. The adjourned discussion on Dr. H. E. Armstrong's paper, "On Systematic Nomenclature," was continued, in which Prof. Odling replied at length to the criticisms on the article recently published by him on the same subject in the *Philosophical Magazine*.

April 28th.—Special Meeting.—Prof. Andrews delivered a lecture "On Certain Methods of Chemical Research." In the course of the lecture, he exhibited and described the various apparatus employed by him in his researches on the heat developed during chemical combination; in his experiments on ozone, and on the relation between the pressure and tension of matter in the gaseous state, giving many interesting and valuable details of the precautions necessary to be employed in experiments of this kind. At the close of the lecture, he exhibited the striking experiment of the action of heat on liquid sulphurous anhydride, in causing it to pass into the "intermediate state,' in which it is neither liquid nor gaseous.

May 4th.—Dr. Gilbert, V.P., in the chair.—The following communications were read: "On Glycero-Phosphoric Acid and its Salts, as obtained from the Phosphorized Constituents of the Brain," by Dr. J. L. W. Thudichum and Mr. C. T. Kingsett, "On some Re-actions of Biliverdin," by Dr. Thudichum,—"On the Relation between Chemical Constitution and Colouring Power in Aromatic Substances," by Dr. O. Witt,—"On certain Bismuth Compounds," by Mr. M. M. P. Minz,—"A New Method for Preparing the Hydrocarbons Diphenyl and Isodinaphthyl, and on the Action at a High Temperature of Metallic Chlorides on certain Hydrocarbons," and a "Note on the Occurrence of Benzine in Rosin Light Oils," by Mr. W. Smith,—"On the Action of Water and of various Saline Solutions on Copper," by Mr. T. Carnelley,—and "Notes on some Experiments made to ascertain the Value of a proposed Method of Determining the Mineral Strength of Soils by means of Water Culture," by Mr. G. A. Hight.

MICROSCOPICAL SOCIETY.

MAY 3RD.—H. C. Sorby, Esq., President, in the chair.—Mr. C. Brooke proposed a special vote of thanks to the President for the Conversazione given by him on the 21st ult.—Count Castracane was elected an Honorary Fellow of the Society, and M. Rénard, of Louvain, and Dr. W. Osler were elected Fellows. A paper was read, by Mr. Blake, "On the Occurrence of what appeared to be Foraminifera in the Coralline Oolites," and specimens in illustration were exhibited under microscopes in the room. Mr. J. Glaisher communicated a paper, by Dr. Gayer, describing the apparatus employed and the process adopted by him in India, for the purpose of taking photo-micrographs with high powers, and some excellent specimens were exhibited in the room and subsequently presented to the Society. A paper, by Dr. J. J. Woodward, "On the Markings of the Body Scale of the English Gnat and the American Mosquito," was read, and was also illustrated by a series of photo-micrographs. Some notes upon the same subject by Dr. Anthony were also communicated. A short paper, by Mr. Stodder, "On the Identity of *Frustulia Saxonica*, *Navicula Rhomboides*, and *N. Crassinervis*," was read. Mr. C. Stewart called attention to a curious living organism exhibited by Mr. Badcock, and which the Fellows present were requested to examine with a view to its identification.

PSYCHOLOGICAL SOCIETY.

APRIL 20TH.—Mr. Serjeant Cox, President, in the chair.—Mr. R. Bell was elected a Member. Some reports of psychological phenomena were read. The Secretary announced that a Committee had been formed, in pursuance of the suggestion of the President of the Anthropological Institute, to prepare definitions of the terms frequently used in Psychology, to be afterwards submitted to the Institute. The President read a paper "On the Pyschology of Wit and Humour." Much discussion followed.

May 4th.—Mr. Serjeant Cox, President, in the chair.—The Rev. C. J. Taylor, Capt. Kelso, Mr. W. W. Westcott, were elected Members. Communications of psychological phenomena were read. Mr. G. Harris read a paper answering the objections made to evidence of facts in psychology, which was followed by an animated discussion, in which Mr. C. C. Massey, Mr. Coffin, the President, and others took part.

MATHEMATICAL SOCIETY.

MAY 11TH.—Prof. H. J. S. Smith, President, in the chair.—Dr. Logan was elected a Member. Mr. Tucker communicated a paper, by Mr. S. A. Renshaw, "On the Inscription of a Polygon in a Conic Section, subject to the Condition that each of its Sides shall pass through a given Point, by the aid of the generating Circle of the Conic." Prof. Cayley spoke "On the Representation of Imaginary Quantities by an (n, n) Correspondence." Prof. Cayley having taken the chair, the President communicated two notes, one "On the Value of a Certain Determinant," and the other, "On a Method of Solving the Pellian Equation."

HISTORICAL SOCIETY.

MAY 11TH.—Dr. B. W. Richardson in the chair.—Lieut. Cameron was elected an Honorary Member, and sixteen ordinary Members were added to the roll. Mr. J. Fisher read a paper "On the History of Land-holding in Ireland," and Mr. G. Browning gave an account of his explorations in Ireland, illustrated with a variety of relics.

STATISTICAL SOCIETY.

MAY 16TH.—W. G. Lumley, Esq., V.P., in the chair.—Messrs. J. O. Adams, A. Ashby, I. Abrahams, and J. Hilton were elected Fellows. A paper was read, by Dr. W. Farr, "On the Valuation of Railways, Mines, Telegraphs, and other Commercial Concerns, with Prospective, Deferred, Increasing, Decreasing, or Terminating Profits." The paper was illustrated by copious tables and scientific formulæ for calculating values in the various circumstances mentioned. In the discussion which ensued, Messrs. D. Chadwick, Martin, Purdy, Hendricks, Walford, Vigors, and Fisher took part.

ENTOMOLOGICAL SOCIETY.

APRIL 5TH.—Prof. Westwood, President, in the chair.—Messrs. J. W. Douglas, E. C. Rye, C. Fenn, G. Lewis, J. D. Kay, and W. C. Copperthwaite, were elected Ordinary Members; and Mr. B. A. Bower, jun., was elected a Subscriber.—Mr. F. Bond exhibited a specimen of *Xylina lambda*, taken near Erith, in September last, by Mr. W. Marshall, being the fifth instance of its having been taken in Britian. He also exhibited *Ebulea stachydalis*, taken by himself at Kingsbury, Middlesex, in June, 1862.—Mr. Champion exhibited specimens of *Ægialia rufa*, taken by Mr. Sidebotham near Southport; and he brought examples of *Psammodius sulcicollis*, for distribution.—The President made some observations respecting the habits of the common gnat, in continuation of his remarks at the meeting of the 4th of November, 1872. Large numbers of females had again appeared in his house at Oxford, not a single male having been observed. He believed that they had hibernated in the house, appearing during the first warm days of spring. He also remarked that Dr. Leconte's valuable collection of Coleoptera had been presented to the University at Cambridge, Mass.—Sir S. S. Saunders exhibited living examples of *Stilops Kirbii*, taken by himself at Hampstead; altogether he had found eighteen males.—Mr. Enock also exhibited a row of eleven males taken on the wing at the same place.—The Rev. A. E. Eaton stated that he was preparing a supplement to his monograph on the Ephemeridæ (*Trans. Ent. Soc.* 1871), chiefly from materials in the collections of Mr. M'Lachlan and Mr. Albarda; and that he would be glad of any assistance that would be given by entomologists possessing insects belonging to that group. It appeared that the deficiency in legs in Campsurus and some of its allies was due to their being shed with the pupa-skin when the insect obtains well-developed wings, and that in some forms all the legs were thus cast off by the female.—Mr. Smith remarked on the distribution of some genera of hymenopterous insects from New Zealand, of which a collection had been placed in his hands by Mr. C. M. Wakefield; and was followed by Mr. M'Lachlan, who remarked on the gradual extinction of the endemic Fauna of New Zealand, although introduced forms throve wonderfully.—The Rev. R. P. Murray stated that he was preparing a list of species of Japanese butterflies, and that he would be grateful to any entomologist who could assist him with the loan of specimens.—Mr. M'Lachlan exhibited a series of *Anomalopteryx Chauviniana*, Stein., from Silesia, given to him by the discoverer of the species, Fraulein Marie von Chauvin, of Freiburg. This singular Trichopterous insect pertained to the family of Limnophilidæ, and was remarkable for the lanceolate anterior and abbreviated posterior wings of the male; those of the female being normal, excepting that the posterior wings were smaller than usual. Also apterous females of *Acentropus niveus*, received from Mr. Ritsema, of Leyden; and a microscopic slide, with a full-grown female example of *Phylloxera vastrix* of the root form. This he had recently obtained, with many others, from a vinery near London, which was greatly infested with the insect.

May 3rd.—Sir S. S. Saunders, V.P., in the chair. M. J. Lichtenstein, of Montpellier, was elected a Foreign Member. The Rev. J. Hellins sent for exhibition various British Lepidoptera recently submitted to M. Guenée for his opinion and determination. One of the most important was a Noctua, bearing some resemblance to *Xanthia ferruginea*, not known to M. Guenée, taken at Queenstown, over bramble blossoms in July or August, 1872, by Mr. G. F. Mathew. It was also unknown as European to Dr. Staudinger. Mr. Distant exhibited a series of six examples of the butterfly, *Ithomia Tutia*, Hewitson, from Costa Rica, showing a very considerable variation in markings to which the specie is evidently liable. He also communicated some remarks "On the Rhopalocera of Costa Rica," with descriptions of species not included in the catalogue of Messrs. Butler and Druce, published in the *Proceedings* of the Zoological Society for 1874. Mr. Douglas exhibited specimens of the Corozo-nut (*Phytelephas macrocarpa*), the vegetable ivory of commerce, of which the interiors were entirely eaten away by a species of Caryoborus (one of the Bruchides.) A specimen of the beetle was shown with nuts from the London Docks, which had been recently imported from Guayaquil. The Secretary read a letter he had received from the Foreign Office Department, enclosing a despatch from her Majesty's Minister at Madrid, relative to the steps taken to check the ravages of the locust in Spain. It appears that considerable apprehension was felt in many parts of Spain that the crops of various kinds would suffer greatly this year from the locust, and the Cortes has already voted a large sum to enable the Government to take measures to prevent this calamity. By a circular addressed to the provincial governors by the Minister of Fomento, published in the *Official Gazette*, they were directed to make use of the military forces stationed within their respective districts to aid the population in this object. It was stated that thirteen provinces were threatened with this plague.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

MAY 2ND.—Sir C. Nicholson, Bart., V.P., in the chair.—The paper read was, "On the Babylonian Codex of Hosea and Joel, now at St. Petersburg, date 916 A.D., compared with the Masoretic Text as now Accentuated," by Rev. C. D. Ginsburg. Several gentlemen took part in the discussion which ensued. Owing to the lateness of the hour the following papers were taken as read: "On the Interpretation of the Hamathite Inscriptions," by Rev. A. H. Sayce,—"The Mammalia of the Assyrian Sculptures, Part II. Wild Mammalia," by the Rev. W. Houghton,—and "Some Observations on the Name of an Egyptian Dog," by Prof. G. Maspero.

ASIATIC SOCIETY.

April 24th.—Sir E. Colebrooke, Bart., M.P., President, in the chair.—Major-General J. Abbott was elected a Resident Member.—A paper was read by Mr. E. Thomas, "On Bactrian Coins and Indian Dates;" and by Mr. A. H. Schindler "On Persian Belachistán," being a translation of an official report drawn up by Mirza Mehdy Khán. Mr. Fergusson read part of a letter from E. C. Bayley, Esq., dated Calcutta, March 24, 1876. In this letter Mr. Bayley states that a selection from the Yusufzya sculptures, weighing about twenty-two tons, has been sent home in the Duke of Argyll, comprising statues, pillars, sacred subjects, &c., together with the whole of the carved facings of the steps discovered at Jamalgiri, representing various "*Jatakas.*" He adds, that General Cunningham has found two *dated* inscriptions of Asoka, one "when— years after the Nirvana of Bhagavat had been fulfilled," only, unfortunately, the central figure in both is of doubtful reading. The first and last are 200 and 6, pretty certainly. General Cunningham thinks the intermediate one is 8; Dr. Bühler, on the other hand, 2. Dr. Bühler has made a very interesting discovery. In the centre of an old mosque he has found, still standing in its original site, but forming an integral part of the mosque, the building of the Sanskrit School erected by Rája Dhar. On one pillar are the Sanskrit conjugations, on another, opposite, the Sanskrit declensions. All about, are quaint, punning Sanskrit *slokas*, in praise of Raja Dhar. The rest of the mosque is built up of pillars, &c., taken from destroyed temples.

Correspondence.

PATENT LAW REFORM.

To the Editor of the Scientific and Literary Review.

Sir,—The Lord Chancellor's new Patent Law Bill for 1876 states, that provisional protection can be extended from six to twelve months, *i.e.*, if the Lord Chancellor thinks well to do so. Every inventor must admit that the extension of time is of the utmost importance; but to do so in some cases and not in others would be a great injustice to some inventors, as the first payment of any fee ought to protect the invention for at least twelve months in all cases. For the first two months the specification or models might not be fully made known to the public, and any improvements made during the time allowed; an extra small fee could be then charged by Government. Now, the meaning of the word provisional is, serving for present use. According to a case decided by a late Lord Chancellor, a few years since, A, the first inventor, takes out provisional protection, and another inventor, B, applies for a patent exactly similar to the first inventor's invention. B in due time pays the next fees a little earlier than A; then A applies also for the above. On the case being tried before his Lordship, it was decided that the first inventor's (A) patent did not stand good, but B's patent did. So the true and first inventor was deprived of his rights. Now the question I must ask is, will this state of the law be altered in the Lord Chancellor's new Bill? Could you bring this subject before the next meeting of the Inventors' Institute?—I remain, sir, yours faithfully,

H. E. H. (Inventor).

COMPULSORY VACCINATION.

[By a Correspondent.]

That historical and social phenomena are subject to invariable laws like ordinary physical phenomena has long been admitted; but that those laws are discoverable like physical laws by induction and verification has been established in very recent times. As John Stuart Mill himself affirms in the later editions of his "Logic," the notion had sprung up and received practical demonstration since the first appearance of that world-famous publication. "At the time of the first publication of this treatise," he says, "it was almost a novelty, and the prevailing habits of thought on historical subjects were the very reverse of a preparation for it. Since then a great change has taken place, and has been eminently promoted by the important work of Mr. Buckle."

The rapid development of statistical science has of late become so marked and been so productive of startling and important results, as to have completely thrown into the shade and even reversed many of the miserable, hasty and altogether unwarranted generalizations made by pseudo-savants and empirical sophists of ten or twelve years ago. Thus it befalls that all or nearly all the judgments of society based on statistics anterior to the last decade require complete revision, and in nine cases out of ten such revision when made shows the need which existed for it. Upon such flimsy theoretical structures the breath of modern scientific criticism falls like the wind and the storm that beat upon the house built on the sands.

The bare enumeration and confutation of these tottering doctrines would fill a volume, and my space is limited. I will therefore pass at once to the consideration of an extraordinary theory which has up to the present received too little attention, which has risen to the elevated position of a State-warranted dogma, and which, like the State-religions of old, has been and is used as a ground of State-persecution. *If* this belief in vaccination should after all turn out to be based on erroneous and imperfect figures and false inductions; *if* it should eventually be incontestably proved that so far from preventing or even ameliorating the ravages of small-pox, vaccination has on the contrary considerably increased infant mortality and helped to spread several loathesome diseases; *if*, in fine, the whole foundations of the notion should dissolve beneath the glare of unprejudiced enquiry and the searching rays of science; what then shall we have to show as a set-off against the evils of compulsory vaccination?

I do not wish to beg the question. All I contend is, that judging by analogy, such *may* be the fate of the cowpox hypothesis, and upon such a supposition I ask, What have we to show? First of all we have the proven and unwarrantable robbery and plunder of hundreds of honest citizens by the State. Are we prepared to refund these stolen tens of thousands? It will be difficult. They fall under three principal heads—the fees and grants paid to public vaccinators alone amounting to tens of thousands of pounds sterling, wrung from the hard earnings of unbelieving and unwilling ratepayers and tax-payers; the enormous cost of maintaining hundreds of vaccination officers and other petty Board-satellites and stipendiary magistrates, whose time is taken up in hunting out and persecuting the very men who are, by assumption, in the right; and lastly, the fines and costs inflicted upon such men when caught.

But the money difficulty is but a secondary one. Of far greater importance is the next charge laid at our door. What is all this contempt for the law as a whole? Why is it no longer a disgrace to stand at the criminal bar in a police-court? Because gentlemen of position stand there now. It is an honour and no shame to defy the law when right and conscience are on our side. Do his neighbours and acquaintance cut a gentleman because he refuses to obey the Vaccination Acts? No, he dines the same evening with the magistrate, who smilingly regrets to be obliged to fine him 20s. and costs in the afternoon. Why, then, should the rough convicted of "bagging" what doesn't belong to him be tabooed by his acquaintance?

Wrong and right used to be associated with guilty and not guilty. Now it is otherwise. Guilty often means heroic, and if in one case why not in all? One of the officials in the Marylebone Police-court not long ago informed one of the anti-vaccination *criminals* that the new courts were built on purpose for the respectable people who could not put up with the old ones; the *respectable criminals*. And so the sentiment originates and spreads from the lower to the higher classes, from individuals to societies, and even whole communities and municipalities. Keighley, like some semi-independent town of old, rebels against a central despotism, and the whole country looks on and applauds her for her pluck. Gainsborough follows suit. Brighton is about to do the same. Here is the old story of Platæa, of Thebes and of Sparta. How does the State propose to deal with this rebel little northern town of Keighley? Will another mandamus be issued? And what if the stout burgesses snap their fingers at it? Will a military occupation take place, and martial law and a state of siege be proclaimed! What a ridiculous situation we are drifting into *if* we prove to have been deluded.

Surely before going further a re-examination of the whole argument should be undertaken by competent persons, and in the meantime the Vaccination Acts 1867 and 1871 should be at least temporarily suspended so far as prosecutions are concerned. While suspending our own judgments on the question at issue, let us admit that new evidence is daily springing up against the received doctrine; and a work entitled "Historico-critical Studies on the Present Position of the Vaccination Question," by Prof. Germann, of Leipsic, *must* be read and answered.

W. D.

RAILWAY ROLLING STOCK CAPACITY IN RELATION TO THE DEAD WEIGHT OF VEHICLES.

By Mr. W. A. Adams, Assoc. Inst. C.E.

Forty years ago the travelling carriage accommodating four persons inside, hung on C-springs and resting on a heavy under carriage, weighed upwards of 1½ ton; but the improvements made since then had resulted in the construction of broughams giving the same accommodation and leg room, and weighing only 6 cwt. 1 qr. When railways were first opened freight vehicles were fitted with buffing and drawing springs, but the types had gradually increased in dead weight, the use of spring buffers had been discontinued in coal and mineral waggons, and the increased dead weight necessitated heavier locomotives, heavier roads, and heavier repairs. In order to have a waggon economical in first cost and in cost of repair, extending over terms of years, the Author had departed from the ordinary type of construction, introducing plank bodies, all the soles and head-stocks being of sound, straight English oak, cross-beams of the same, the diagonals and longitudinals of fir, and the frame held together by longitudinal and cross tie-rods. The floors were of fir, and to increase the rigidity of the frame the floor boards were laid longitudinally, rebating on to the head-stocks flush with the top of the soles and head-stocks, and spiking firmly to the flat diagonals. The frame thus panelled was practically solid. This type tared under 3 tons 5 cwt., the other builders tared about 3 tons 15 cwt., the difference in weight representing a difference in cost. They were not, however, approved by the railway companies, whose varied and conflicting regulations all tended to enforce greater dead weight.

On the Midland Railway there was a large traffic in beer in barrels, and the 6-ton waggons did not convey more than 3 tons. Most of the waggons worked back empty, so that the Midland Company in their beer trade carried, full and empty, 12 tons 8 cwt. of dead weight for every 3 tons of paying load, receiving payment for less than one-fourth of all they moved. On the Great Western Railway, 8 tons of paying load were carried on wheels and axles weighing 1 ton 8 cwt. 2 qrs.; on the North Eastern the same load was carried on wheels and axles weighing 1 ton 16 cwt., giving a difference of 7 cwt. 2 qrs. in wheels and axles alone. On the same sidings on the London and North-Western Railway, the coal waggons J. S Claye (3320) and the Gloucester Waggon Company (6593) conveyed the one 1 ton 9 cwt. 3 qrs. per ton of dead weight, and the other 2 tons 7 cwt. per ton of dead weight. On the Midland Railway, the difference of tare between the present waggon and those built twenty years ago by the Author, was 16 cwt.; and presuming that one hundred waggons each worked, full and empty, 200 miles per week, the Company had contracted to convey, free of charge, for the life of the waggon, extending probably over twenty years, an excess of 832,000 tons per year for 1 mile. The Orleans Railway of France adopted in all cases a capacity of 10 tons, thereby effecting a large saving in siding and wharfage accommodation. The Author was of opinion that the American eight-wheel bogie-car was not favourable to a low dead weight, and in practice nearly all the coal mined in Pennsylvania was conveyed in four-wheel waggons. The slate waggons on the Festiniog Railway, did not usually load beyond 3 to 3½ tons of slate, and the coal waggons beyond 4 to 4½ tons of coal; but the proportion of paying to dead weight was more economical than on any other railway. If 3 tons of paying weight to 1 ton of dead weight could be carried upon so inconvenient a guage as 2 feet, as good results should be looked for on the 4 feet 8½ inch guage.—*Abridgement of Paper recently read at the Institution of Civil Engineers.*

DRAMATIC LITERATURE.

OPERA COMIQUE.

THE romantic and fashionable opera, by M. Lecocq, of "La Petite Mariée," performed by the Brussels Opera Company under M. Humbert, has been the attraction lately at this theatre. This is a piece which is remarkable for its length—which does not fatigue—its sparkling dialogue à la Molière, as well as effective music and a good deal of fun. The plot runs about a gay chevalier, who was in the service of the Podestat of Moldavia in the 16th century, Chevalier San Carlo. Much of it comprehends his love-making with the daughter of a very rich marquis, who, having a litigation with the Podestat about some forests, wishes to forward it. However, it turns out that the flirting Chevalier had previously paid attention to some relative of the Podestat, who endeavours unsuccessfully to thwart the marriage, in the course thereof making a mistaken capture. M. Raoult took the part of the Chevalier, and ably carried it through, notwithstanding that both he and Mademoiselle Marie Harlem (the Marquis's daughter, Graziella), had a great deal to do; that is to say, he rendered the gay manners of the part suitably, and sang well. The vocal performances of Mademoiselle Marie Harlem are very charming. Her clear, rich voice, so easily managed, carried the audience with her in all the melodies, and a characteristic of the opera is a good one, that is, a number of pretty airs in it. One of the drawbacks of not a few of the comic operas and burlesques at present or lately offered to the public on the London stage, has been a want of liberality in nice ballads. This prima donna creates a favourable impression in even the first air, and possesses personal attractions. The want of pretension displayed both by her and the other members of the troupe was singular when we viewed the thoroughness of the performance. The French style undoubtedly has its attractions in musical pieces rendered by a troupe not absolutely Parisian. We remember an instance of this at Hamburg, shortly before the Opera House was burnt down, when some sensation was produced by the first lady, whose voice resembled that of Mademoiselle Harlen, but had some louder tones. We suggest to persons who do not understand French to take the two last acts, which are played from 9.30 to 11.30. Owing to the facts we have specified, and to the cheerfulness of the *mise-en-scene*, we do not think a knowledge of the French language at all a *sine quâ non* for enjoying a visit to this theatre, where a variety of French operas will be performed till the end of July. The theatre is under the management of an old favourite, Mr. Horace Wigan. The programmes contain the story and the names of all the airs. The members of the troupe were ably supported by the clever Tambour Major (a lady) and Madame Fêlicie Delorme, and Messrs. Jolly and Geraizer.

CLEAVER'S PATENT TEREBENE SOAP.

TEREBENE (as designed by Dr. Francis T. Bond, B.A., Lond., F.C.S., Medical Officer of Health, Gloucestershire Combined Sanitary District), which is the active principle of this soap, is a liquid, with a somewhat camphoraceous smell in mass, resembling that of oil of thyme. When exposed to the air it volatilises, emitting an odour of a fragrant and agreeable character, which, when diffused through the atmosphere, somewhat recalls that of pine wood. When thus exposed it acts energetically upon the oxygen of the air, developing ozone in it, and at the same time becoming itself charged with peroxide of hydrogen (antozone of Schonbein.)

When added to any decomposing and offensive matter, Terebene acts as a powerful deodorant. It produces the same effect upon a foul atmosphere, not simply by masking the offensive smell by its own odour, as is the case with carbolic acid and other similar strongly-smelling disinfectants, but by developing in the air an agent (ozone) which rapidly oxydizes and destroys the malodorous emanations. It is, therefore, truly an atmospheric purifier. Terebene has also marked antiseptic power, and when added to decomposable matters arrests putrefaction for a considerable time. It is *non-poisonous*, and may be taken internally. In connection with this fact, which is suggestive of its applicability in various cases, it may be noted that Terebene is almost identical in composition with Thymol, the chief constituent of oil of thyme, of the antiseptic powers of which a very strong report has been lately made by Herr Lewin (see *British Medical Journal*, May 22nd, 1875), and that in many of its effects it is very analogous to salicylic acid, to the antiseptic properties of which much attention has been directed of late.

It may be noted in connection with the resemblance of the odour of Terebene vapour to that of pine wood, referred to above, that Dr. Gay, of Geelong, has in several publications drawn special attention to the disinfecting properties of this substance, from its action as an ozonizer, and has recommended its use in the construction of hospitals for infectious diseases on that account.

When Terebene is applied to a raw surface, such as that of a wound, it acts as a stimulant to healthy growth; surfaces that have been inert exhibiting under its influence a rapid tendency to healing. It may also be used in the same way in some affections of the skin, and as a topical application in scarlatinal and other forms of bad sore throat, diphtheria, &c.

From the above statement it will be evident that Terebene is calculated to replace carbolic acid as a deodorant and disinfectant for all ordinary purposes, having three very great advantages over it in the facts—that it is non-poisonous; that its odour, instead of being offensive, is agreeable; and that it is an atmospheric purifier.

Before introducing this soap Mr. Cleaver had, it appears, made numerous experiments in order to satisfy himself of its practical value, and it is now with the greatest confidence in its very valuable disinfecting, astringent, and purifying power—in addition to which it possesses cleansing properties—that he offers it to the public. In its manufacture glycerine is combined with Terebine. It is also agreeably and innocently perfumed. The slight colouring matter used is simply palm oil, respecting the valuable properties of which no remark is necessary.

For use by gentlemen practising the medical profession in removing all unpleasant odour from the hands, also in cases of chapped skin, F. S. Cleaver's patent Terebene soap will be found invaluable. Mr. Cleaver has also applied Terebene in shaving cream, shaving sticks, tooth powder, and cream for the hair, hair wash, &c.

THE INSTITUTION OF CIVIL ENGINEERS.—We are asked to state that the conversazione to be given by Mr. Stephenson (the President) on Thursday, the 1st inst. (to-day), will take place in the South Kensington Museum itself, instead of in the galleries devoted to the Scientific Apparatus Exhibition. Both entrances to the Museum, viz., in Cornwall-road and Exhibition-road, will be open.

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Several leading members of the Inventors' Institute, coming daily in contact with Inventors, whose wants and difficulties were daily pressed on their attention, formed themselves into this Association, entitled "The Inventors' Patentright Association, Limited," in order to supply Inventors with the best and most reliable information and advice—to provide skilled references on questions of science and manufacture—to render legal processes for protecting and maintaining patent rights safe, cheap, and ready—and to aid Inventors in bringing their inventions into practicable and profitable shape. To carry out these views, the following are the

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To obtain Patents for Inventions in this and other countries.
To Register Designs.
To aid in forming Public Companies, and in introducing Publicly Patented Inventions.
To aid in Selling and Licensing Patented Inventions.
To furnish advice and professional Assistance in developing Inventions.
To collect Evidence, arrange Arbitrations, and otherwise assist Inventors in maintaining their rights.

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